COLLINS

overhaul manual

Collins Radio Company

844A-1
VOR/LOC Instrumentation Planar Assembly (Part of 51RV-2B)

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(E) Unit subassembly number (where applicable)

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maintenance manual
(with installation data)

51RV-2B
VOR/ILS Receiver

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51RV-2B VOR/ILS Receiver

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FOREWORD

This manual has been prepared in accordance with Air Transport Association Specification No. 100 for Manufacturers' Technical Data. If used as intended, this manual will greatly facilitate the effective, continued operation of the 51RV-2B VOR/ILS Receiver.

This manual is intended for use by flight line and hangar maintenance personnel. A detailed description, including complete specifications, is given for the equipment. Operation of the equipment is described. Preinstallation and postinstallation test procedures, mounting, and cabling information are presented as an aid to both initial installation and periodic maintenance. Troubleshooting information is limited to procedures required to trace a trouble to an easily replaceable unit.

The following is a list of related publications.

PUBLICATION	COLLINS PART NUMBER
51RV-2B VOR/ILS Receiver Overhaul Manual (with illustrated parts list)	523-0760757
1051B-1 VHF NAV Receiver Planar Assembly Overhaul Manual	523-0760759
844A-1 VOR/LOC Instrumentation Planar Assembly Overhaul Manual	523-0760756
951A-1 Glideslope Receiver Planar Assembly Overhaul Manual	523-0760760
313N-1 Radio Set Control Instruction Book	523-0722000
313N-2 Control Unit Instruction Book	523-0754001
313N-3 Control Unit Instruction Book	523-0752001
313N-4/4A/4B/4C/4D VHF Control Instruction Book	523-0756631
313N-6/6B/6C/7 VHF Control Instruction Book	523-0756633
37P-2/3/4/5 Glideslope Antenna Instruction Book	523-0755809
37J-3 VHF Navigation Antenna Unit Instructions	TD-181
390Y-1/2 Shockmount Overhaul Manual (with illustrated parts list)	523-0756911
329B-4( ) Approach Horizon Overhaul Manual	523-0756042
329B-6D/E Flight Director Indicator Overhaul Manual	523-0755792
329B-7/7( ) Flight Director Indicator Overhaul Manual	523-0756711
329B-8C Flight Director Indicator Overhaul Manual	523-0757538
331A-4( ) Course Indicator Overhaul Manual	523-0755469
331A-6A Course Indicator Overhaul Manual	523-0756910
331A-6D/6E/7/7A Course Indicator Overhaul Manual	523-0755793

51RV-2B VOR/ILS Receiver
Figure 1

51RV-2B VOR/ILS Receiver - Description and Operation

1. GENERAL.

This section presents the purpose, specifications, description, and theory of operation for the 51RV-2B VOR/ILS Receiver. Refer to figure 1 for an overall view of the 51RV-2B. Figure 2 is a table of equipment covered in this manual.

EQUIPMENT	FREQUENCY RANGE	COLLINS PART NO.
51RV-2B	VOR/LOC, 108.00 to 117.95 MHz Glideslope, 329.3 to 335.0 MHz	522-4280-001
51RV-2B	VOR/LOC, 108.00 to 117.95 MHz Glideslope, 329.3 to 335.0 MHz	522-4977-001
51RV-2B	VOR/LOC, 108.00 to 117.95 MHz Glideslope, 329.3 to 335.0 MHz	777-1480-001

Equipment Covered
Figure 2

2. PURPOSE OF EQUIPMENT.

The 51RV-2B VOR/ILS Receiver receives VOR, localizer, and glideslope signals and provides outputs to operate deviation, standard flag, high power flag, and to/from indicators; the VOR pointer of an RMI (radio magnetic indicator); and the aircraft audio system.

When tuned to a VOR frequency, the 51RV-2B will operate with an external course indicator that provides a 400-Hz, electrically zeroed course resolver. When installed in the aircraft, outputs are provided from the 51RV-2B to operate VOR deviation and to/from indicators, a VOR warning flag in the course indicator, an RMI VOR bearing pointer, and to supply an aural output.

When tuned to a localizer frequency, the corresponding glideslope frequency is automatically selected. Outputs are provided from the 51RV-2B to operate localizer and glideslope deviation indicators and ILS warning flags in the course indicator and to supply an aural output.

The 51RV-2B also provides VOR and ILS deviation and flag data as computer inputs for flight director and autopilot systems. Associated equipment that may be used with the 51RV-2B is listed in figure 3.

EQUIPMENT	COLLINS PART NUMBER	DESCRIPTION	FUNCTION
37P-4 Glideslope Antenna	522-0688-013	For use with single glideslope receiver, 0.7 lb (.32 kg)	Receives glide-slope navigation signals (uhf).
37P-5 Glideslope Antenna	522-0700-003	For use with two glide-slope receivers, 0.7 lb (.32 kg)	Receives glide-slope navigation signals (uhf).
Type N coaxial plug	557-9040-00	UG-21B/U, 0.1 lb (.05 kg)	Antenna connector.
BNC-to-N adapter	357-9056-00	UG-201/U, 0.1 lb (.05 kg)	For use with 37P-4 antenna.
137X-1 VHF NAV/ COMM Antenna	522-1136-000	Vhf antenna, 4.7 lb (2.13 kg)	Receives VOR/LOC navigation signals (vhf).
or			
37J-3 VHF Navigation Antenna	505-6800-00	Vhf antenna, 5.75 lb (2.61 kg)	
or			
837B-1 VOR/LOC Antenna	758-5703-001	Vhf antenna, 2.6 lb (1.18 kg)	
313N-1 Control	522-2446-004	Remote control	Provides remote frequency, volume, and self-test control.
or			
313N-2 Control	522-2447-005	Remote control	
or			
313N-3 Control	522-2448-005	Remote control	
or			
313N-4B Control	522-3614-000	Remote control	
or			

Associated Equipment (Sheet 1 of 2)
Figure 3

EQUIPMENT	COLLINS PART NUMBER	DESCRIPTION	FUNCTION
313N-4D Control	522-3616-000	Remote control	
or			
313N-6B Control	522-3690-000	Remote control	
Flight director indicator		Collins 329B-6( )/ 7( )/8( )	Provides aircraft position with respect to glide-slope beam and computed lateral guidance steering information.
or			
Approach horizon		Collins 329B-4( ) or equivalent	
Course indicator		Collins 331A-4( )/ 6( )/7( ) or equivalent	Provides pictorial display of aircraft position with respect to localizer course or omni-range radio.
Radio magnetic indicator (RMI)	482-0061-00	Collins 332C-4 or equivalent	Provides magnetic heading and station bearing information.
390Y-1 Shock-mount	522-3060-00	Shockmount, 1.7 lb (.77 kg)	Provides shock-mounting for the 51RV-2B.

Associated Equipment (Sheet 2 of 2)
Figure 3

3. EQUIPMENT SPECIFICATIONS.

The 51RV-2B VOR/ILS Receiver specifications are listed in figure 4.

CHARACTERISTIC	SPECIFICATION
General	
Size	ARINC Specification No. 404, 1/2-ATR short (including interconnect unit).
Weight	19.5 lb (8.84 kg).
Design specifications	TSO C-34b, C-36b, and C-40a.
	Environmental category $\frac{A}{D}$ A $\frac{A}{B}$ AAAE.
	ARINC Characteristic 547.
	FCC rules and regulations; part 15.
Environmental specifications	
Temperature	
Continuous operation	-54 °C (-65.2 °F) to +55 °C (+131 °F).
Intermittent operation (30 minutes maximum)	Up to +71 °C (160 °F).
Storage	-65 °C (-85 °F) to +85 °C (+185°F).
Humidity	95 to 100% at +50 °C (+122°F) for 48 h.
Altitude	Up to 55,000 ft (16.77 km).
Shock	
51RV-2B in shockmount	15 g operating, 30 g impact (10 ms duration).
51RV-2B in rigid mount	6 g operating, 15 g impact (10 ms duration).
Vibration	
51RV-2B in shockmount	0.03 in (.08 cm) double amplitude, 5 to 55 Hz; 5 g, 55 to 500 Hz. 180 minutes in each of three planes as per RTCA paper 120-61/DO-108, category A.
51RV-2B in rigid mount	0.02 in (.05 cm) double amplitude, 5 to 55 Hz; 1.5 g, 55 to 500 Hz. 180 minutes in each of three planes as per RTCA paper 120-61/DO-108, category A.

Equipment Specifications (Sheet 1 of 7)
Figure 4

CHARACTERISTIC	SPECIFICATION
Electrical specifications	
Susceptibility	
Conducted audio	1.4 vrms from 200 to 20,000 Hz on +27.5-vdc power leads. 1.3 vrms from 800 to 9000 Hz on 26-vac, 400-Hz power leads.
Conducted rf interference	An rf signal which varies between 90 kHz to 30 MHz, modulated 30% at 1000 Hz with the rf level varying between 80 and 63 db above 1 uv per RTCA paper 120-61/DO-108.
Radiated rf interference	An rf signal which varies between 90 kHz to 1000 MHz, modulated 30% at 1000 Hz with the rf level varying between 63 and 93 db above 1 uv per RTCA paper 120-61/DO-108.
Cross modulation	
VOR/LOC and glideslope	Meets the following specifications: VOR: Per RTCA papers 225-55/DO-69 and 48-62/DO-114. LOC: Per TSO C-36b and RTCA paper DO-131. GS: Per TSO C-34b and RTCA paper DO-132.
Channel selection time	Not more than 1 second.
Power source	
Dc	+27.5 vdc +10% -20% with negative lead grounded.
Ac	26 vac, 380 to 420 Hz (instrument power).
Power requirements	
VOR	+27.5 vdc, 40 w; 26 vac, 400 Hz, 16 va.
ILS	+27.5 vdc, 40 w; 26 vac, 400 Hz, 16 va.

Equipment Specifications (Sheet 2 of 7)
Figure 4

CHARACTERISTIC	SPECIFICATION
Frequency range	
VOR	108.00 to 117.95 MHz except odd tenths of MHz from 108.1 to 111.9 MHz.
LOC	108.1 to 111.9 MHz, odd tenths of MHz.
Glideslope	329.3 to 335.0 MHz.
Channel increments	
VOR	50 kHz.
LOC	200 kHz.
Glideslope	300 kHz.
Number of channels	
VOR	180.
LOC	20.
Glideslope	20.
Frequency stability, 1051B-1 VHF NAV Receiver and 951A-1 Glideslope Receiver	Resonant frequency does not deviate from selected channel frequency by more than 0.001% under the following conditions taken one at a time: 1. The dc input voltage is varied from +22.0 to +30.25 v. 2. The ambient temperature is varied from -54 °C (-65 °F) to +55 °C (+131 °F). 3. The humidity is varied from 10 to 95% at +50 °C (+122 °F). 4. The pressure is varied from normal to that equivalent to an altitude of 55,000 ft (16.77 km). 5. The transistors are exchanged in a random manner for like transistors that are within ARINC specifications.

Equipment Specifications (Sheet 3 of 7)
Figure 4

CHARACTERISTIC	SPECIFICATION
Spurious response	
1051B-1 VHF NAV Receiver	80 db down min.
951A-1 Glideslope Receiver	70 db below desired signal in the frequency range of 0.09 to 1500 MHz.
Selectivity	
1051B-1 VHF NAV Receiver	±25 kHz min bandwidth at 6 db; ±45 kHz max bandwidth at 60 db.
Sensitivity	
1051B-1 VHF NAV Receiver	
Audio channel	6-db s+n/n ratio for a 3-uv signal modulated 30% at 1000 Hz.
VOR channel	With a 3-uv standard VOR test signal as per RTCA paper DO-69, the indicator flag is fully masked, and satisfactory navigation performance is obtained.
951A-1 Glideslope Receiver	With a 2-db audio ratio and with the course sensitivity control adjusted for 78 ua, 47 ua are obtained on all channels with an input of not more than 5 uv.
Output circuits	
VHF NAV receiver	
Audio output	600 ohms balanced and center tapped; 100 mw nominal output at 30% modulated.
Audio frequency response	Not more than 6 db variation from 300 to 3750 Hz with a 1000-uv signal modulated 30% and an initial 1000 Hz audio output of 100 mw. Sharp cutoff in response below 300 Hz and above 3750 Hz is provided.
Audio output regulation	With 100 mw into 600 ohms, the audio power output is not less than 50 mw or more than 200 mw when load resistance is changed from 300 to 1200 ohms.

Equipment Specifications (Sheet 4 of 7)
Figure 4

CHARACTERISTIC	SPECIFICATION
844A-1 VOR/LOC Instrumentation	
VOR/LOC deviation output	Five 1000-ohm loads; internal dummy loads; 150 ua/10 degrees VOR, 90 ua/4 db LOC.
Monitor VOR/LOC deviation output	Two 1000-ohm loads.
VOR/LOC flag output	Flag load can consist of up to four 1000-ohm loads in parallel. Dummy loads are not required.
To/from output	A dc output is provided for two parallel 200-0-200-ua ±20% meters each having 200 ohms ±15% internal resistance.
VOR/LOC high power flag output	+27.5 vdc at 250 ma.
951A-1 Glideslope Receiver	
Glideslope deviation output	Five 1000-ohm loads in parallel; internal dummy loads.
Monitor glideslope deviation output	Two 1000-ohm loads.
Glideslope flag output	Flag load can consist of up to four 1000-ohm loads in parallel. Dummy loads are not required.
Glideslope high power flag output	+27.5 vdc at 250 ma.
VOR accuracy	
Manual channel	
Standard conditions	Less than ±0.5 degree of azimuth runout error.
Service conditions	Within ±0.5 degree with 95% probability under max environmental conditions.
Automatic channel	Less than ±1.0 degree. RMI card servo-amplifier null width is less than ±0.5 degree.

Equipment Specifications (Sheet 5 of 7)
Figure 4

CHARACTERISTIC	SPECIFICATION
VOR monitoring	
Automatic channel	Flag warning detects level drop of 2 db or 2-degree bearing error between the monitor channel and primary channel.
Manual channel	Flag warning detects level drop of 2 db or 1-degree bearing error between secondary channel and primary channel.
Frequency synthesizer	Flag warning detects synthesizer out of lock.
LOC accuracy	
Standard conditions	Less than ±2 ua centering.
Service conditions	Less than ±4 ua centering with 95% probability under max environmental conditions.
LOC monitoring	Flag warning detects the following: 1. Level drop of 2 db. 2. Centering error of 5 ua (adjustable) between the secondary channel and primary channel. 3. Frequency synthesizer out of lock.
Glideslope accuracy	
Linearity	A varying audio ratio from 0 to 4 db results in linear deflection sensitivity within 10% or 3 ua, whichever is greater.
Balance	When receiver is adjusted to provide 78 ua with a 700-uv deviation signal, with 90 Hz being greater than 150 Hz, the deviation of opposite polarity obtained when the signal is modulated with 150 Hz greater than 90 Hz is within 4% of 78 ua.

Equipment Specifications (Sheet 6 of 7)
Figure 4

CHARACTERISTIC	SPECIFICATION
Centering	
Standard conditions	Less than ±3 ua.
Service conditions	Less than ±6 ua with 95% probability under max environmental conditions.
Glideslope monitoring	Flag warning detects the following: 1. Level drop of 2 db. 2. Centering error of 5 ua (adjustable) between the secondary channel and primary channel. 3. Frequency synthesizer out of lock.
680T-1 VHF Synthesizer	
Frequency range	116.000 to 153.975 MHz.
Channel spacing	25 kHz.
Stability	
Short term	±10 ppm over operating temperature and voltage range.
Long term	1 to 2 ppm per year.
Channel switching time	Not more than 1 second.

Equipment Specifications (Sheet 7 of 7)
Figure 4

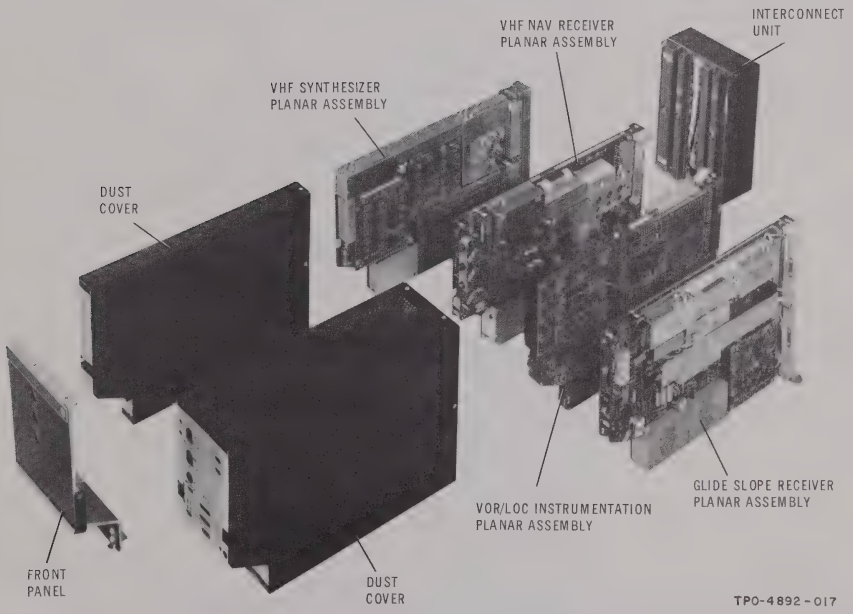
4. EQUIPMENT DESCRIPTION.

A. Mechanical Description. (Refer to figure 5.)

The 51RV-2B VOR/ILS Receiver consists of four planar assemblies and an interconnect unit. The planar assemblies are designated the 1051B-1 VHF NAV Receiver Planar Assembly, 844A-1 VOR/LOC Instrumentation Planar Assembly, 951A-1 Glideslope Receiver Planar Assembly, and 680T-1 VHF Synthesizer Planar Assembly.

The 1051B-1 VHF NAV receiver consists of a vhf tuner and an if. circuit, an audio amplifier, a VOR/ILS test generator, an RMI card servo amplifier, and a power

supply. The 844A-1 VOR/LOC Instrumentation consists of dual primary and monitor channels for automatic VOR operation, dual primary and secondary channels for manual VOR operation, and a sensor used for both VOR and localizer operation. The 951A-1 Glideslope Receiver consists of a glideslope receiver, glideslope instrumentation consisting of dual primary and secondary channels, a sensor, and a uhf synthesizer. The 680T-1 VHF Synthesizer consists of oscillators, mixers, and integrated logic circuits.



51RV-2B VOR/ILS Receiver, Planar Assembly Identification
Figure 5

UNIT	FUNCTION	COLLINS PART NUMBER
1051B-1 VHF NAV Receiver (with self-test audio generator and power supply)	Receives 108.00- to 117.95-MHz VOR/LOC signals (provides VOR/ILS self-test audio and +18-vdc and +5-vdc power).	772-0790-001
844A-1 VOR/LOC Instrumentation	Processes VOR and LOC signals to operate RMI, VOR/LOC deviation indicator, to/from indicator, and VOR/LOC flags.	757-0701-001
951A-1 Glideslope Receiver (with uhf synthesizer and glideslope instrumentation)	Receives 329.3- to 335.0-MHz glideslope signals (provides injection frequency to glideslope receiver and processes glideslope signals to operate glideslope deviation indicator and glideslope flag).	757-0700-001
680T-1 VHF Synthesizer	Provides tuning voltage to 1051B-1 VHF NAV Receiver and injection frequency to 1051B-1 VHF NAV Receiver and to uhf synthesizer.	757-0689-001
Interconnect unit	Provides necessary interconnect wiring between four planar assemblies of a 51RV-2B. Also provides for direct interchange from 51RV-1 to 51RV-2B system. This interconnect unit is used with 51RV-2B, Collins part numbers 522-4280-001 and 522-4977-001.	772-0824-001
	Same function as above, only this interconnect unit has two wires removed, and is used with 51RV-2B, Collins part number 777-1480-001.	772-0824-002

51RV-2B Planar Assemblies
Figure 6

Each planar assembly has a planar sideboard with a Collins thin-line connector mounted rigidly to the planar sideboard. Parallel mounted subassembly cards plug directly into the sideboards. This technique provides maximum space for component mounting while keeping the physical size to a minimum.

The 680T-1 VHF Synthesizer Planar Assembly is housed in an individual dust cover. Another dust cover houses the 1051B-1 NAV Receiver Planar Assembly, 951A-1 Glideslope Receiver Planar Assembly, and 844A-1 VOR/LOC Instrumentation Planar Assembly. The planar assemblies slide into the dust covers from the rear. Each sideboard connector is attached to its dust cover. The front panel assembly is fastened to each planar assembly with a screw at the top and bottom of each ATR unit.

The 51RV-2B can be interchanged with the 51RV-1 when the interconnect unit is used. The interconnect unit is a 5-sided aluminum enclosure screw mounted on the rear of the ATR units. It houses the mating connectors for the planar assemblies and the interconnect wiring, including the ARINC DPX2 connector.

Refer to figure 7 for a table of 51RV-2B connectors.

B. Electrical Description.

(1) 680T-1 VHF Synthesizer Planar Assembly.

The vhf synthesizer converts 2-out-of-5 remote control information into binary coded decimal (BCD) information. The digitally stabilized vhf synthesizer provides all of the required injection frequencies and front end tuning voltages for the vhf NAV receiver first mixer. Injection frequencies and tuning voltages cover the 108.00- to 117.95-MHz VOR/LOC band in 50-kHz increments. The synthesizer consists of a logic converter, reference oscillator, and two related phase-locked loops. The vhf synthesizer also provides BCD information, injection frequencies, and a 50-kHz reference frequency to the glideslope receiver planar assembly uhf synthesizer.

(2) 1051B-1 VHF NAV Receiver Planar Assembly.

(a) VHF Tuner and IF. Circuits.

The vhf tuner and if. circuits consist of a voltage variable capacitor tuned vhf front end followed by two if. amplifiers, a detector, and an agc circuit. Tuning over the 108.00- to 117.95-MHz range is accomplished by the vhf injection and dc tuning voltages supplied by the vhf synthesizer. The mixer if. outputs are at 18 MHz and 498.5 kHz. The 18-MHz if. results from mixing the rf input with the VOR/LOC injection frequency from the vhf synthesizer. This 18-MHz signal is reduced to 498.5 kHz by mixing the 18 MHz with an 18.4985-MHz oscillator output. The 498.5-kHz if. is detected and the output is applied to the VOR/LOC instrumentation input. The output is also applied to the audio amplifier for filtering and shaping to produce an aural output.

51RV-2B PLANAR ASSEMBLY CONNECTORS	PLANAR ASSEMBLY	INTERCONNECT UNIT MATING CONNECTORS
Collins part no. 777-0621	680T-1 Synthesizer	Collins part no. 777-0622
Collins part no. 772-0626	1051B-1 NAV Receiver	Collins part no. 772-0700
Collins part no. 768-9098	951A-1 Glideslope Receiver	Collins part no. 768-0699
Collins part no. 772-0718	844A-1 VOR/LOC Instrumentation	Collins part no. 772-0698
INTERCONNECT UNIT CONNECTOR	**FUNCTION**	**SHOCKMOUNT MATING CONNECTOR**
DPX-CA-32W2P57P-34B	51RV-2B interconnect from interconnect unit to shockmount	DPX2-CA-32W2S57S-33B

51RV-2B Connectors
Figure 7

(b) Audio Amplifier.

The audio amplifier provides noise limiting, response shaping, and power amplification for the audio output from the vhf tuner and if. circuits. The aural output from the audio amplifier is applied to the aircraft cockpit audio system.

(c) VOR/ILS Audio Test Generator and Timer.

The VOR/ILS self-test audio generator synthesizes VOR and ILS audio signals that are applied to the self-test oscillators in each receiver. When the 51RV-2B is tuned to a localizer frequency (ILS mode), the test generator is energized by actuating the UP/L or DN/R test switches on the 51RV-2B front panel. In the VOR mode, the self-test is energized by actuating the VOR test switch on the 51RV-2B front panel. All self-test functions can also be initiated from a remote control unit per ARINC Characteristic 547.

(d) RMI Servo Amplifier.

The RMI servo amplifier receives low-level magnetic heading information from the magnetic compass system and amplifies this signal to a level sufficient to drive the RMI compass card.

(e) Power Supply.

The 51RV-2B power supply uses +27.5-volt dc aircraft power to provide the required +18- and +5-volt regulated dc power.

(f) VOR/LOC Mode Relay.

The VOR/LOC mode relay switches VOR power to a VOR circuit when the 51RV-2B is tuned to a VOR frequency, and ILS power to an ILS circuit

Each planar assembly has a planar sideboard with a Collins thin-line connector mounted rigidly to the planar sideboard. Parallel mounted subassembly cards plug directly into the sideboards. This technique provides maximum space for component mounting while keeping the physical size to a minimum.

The 680T-1 VHF Synthesizer Planar Assembly is housed in an individual dust cover. Another dust cover houses the 1051B-1 NAV Receiver Planar Assembly, 951A-1 Glideslope Receiver Planar Assembly, and 844A-1 VOR/LOC Instrumentation Planar Assembly. The planar assemblies slide into the dust covers from the rear. Each sideboard connector is attached to its dust cover. The front panel assembly is fastened to each planar assembly with a screw at the top and bottom of each ATR unit.

The 51RV-2B can be interchanged with the 51RV-1 when the interconnect unit is used. The interconnect unit is a 5-sided aluminum enclosure screw mounted on the rear of the ATR units. It houses the mating connectors for the planar assemblies and the interconnect wiring, including the ARINC DPX2 connector.

Refer to figure 7 for a table of 51RV-2B connectors.

B. Electrical Description.

(1) 680T-1 VHF Synthesizer Planar Assembly.

The vhf synthesizer converts 2-out-of-5 remote control information into binary coded decimal (BCD) information. The digitally stabilized vhf synthesizer provides all of the required injection frequencies and front end tuning voltages for the vhf NAV receiver first mixer. Injection frequencies and tuning voltages cover the 108.00- to 117.95-MHz VOR/LOC band in 50-kHz increments. The synthesizer consists of a logic converter, reference oscillator, and two related phase-locked loops. The vhf synthesizer also provides BCD information, injection frequencies, and a 50-kHz reference frequency to the glideslope receiver planar assembly uhf synthesizer.

(2) 1051B-1 VHF NAV Receiver Planar Assembly.

(a) VHF Tuner and IF. Circuits.

The vhf tuner and if. circuits consist of a voltage variable capacitor tuned vhf front end followed by two if. amplifiers, a detector, and an agc circuit. Tuning over the 108.00- to 117.95-MHz range is accomplished by the vhf injection and dc tuning voltages supplied by the vhf synthesizer. The mixer if. outputs are at 18 MHz and 498.5 kHz. The 18-MHz if. results from mixing the rf input with the VOR/LOC injection frequency from the vhf synthesizer. This 18-MHz signal is reduced to 498.5 kHz by mixing the 18 MHz with an 18.4985-MHz oscillator output. The 498.5-kHz if. is detected and the output is applied to the VOR/LOC instrumentation input. The output is also applied to the audio amplifier for filtering and shaping to produce an aural output.

51RV-2B PLANAR ASSEMBLY CONNECTORS	PLANAR ASSEMBLY	INTERCONNECT UNIT MATING CONNECTORS
Collins part no. 777-0621	680T-1 Synthesizer	Collins part no. 777-0622
Collins part no. 772-0626	1051B-1 NAV Receiver	Collins part no. 772-0700
Collins part no. 768-9098	951A-1 Glideslope Receiver	Collins part no. 768-0699
Collins part no. 772-0718	844A-1 VOR/LOC Instrumentation	Collins part no. 772-0698
INTERCONNECT UNIT CONNECTOR	**FUNCTION**	**SHOCKMOUNT MATING CONNECTOR**
DPX-CA-32W2P57P-34B	51RV-2B interconnect from interconnect unit to shockmount	DPX2-CA-32W2S57S-33B

51RV-2B Connectors
Figure 7

(b) Audio Amplifier.

The audio amplifier provides noise limiting, response shaping, and power amplification for the audio output from the vhf tuner and if. circuits. The aural output from the audio amplifier is applied to the aircraft cockpit audio system.

(c) VOR/ILS Audio Test Generator and Timer.

The VOR/ILS self-test audio generator synthesizes VOR and ILS audio signals that are applied to the self-test oscillators in each receiver. When the 51RV-2B is tuned to a localizer frequency (ILS mode), the test generator is energized by actuating the UP/L or DN/R test switches on the 51RV-2B front panel. In the VOR mode, the self-test is energized by actuating the VOR test switch on the 51RV-2B front panel. All self-test functions can also be initiated from a remote control unit per ARINC Characteristic 547.

(d) RMI Servo Amplifier.

The RMI servo amplifier receives low-level magnetic heading information from the magnetic compass system and amplifies this signal to a level sufficient to drive the RMI compass card.

(e) Power Supply.

The 51RV-2B power supply uses +27.5-volt dc aircraft power to provide the required +18- and +5-volt regulated dc power.

(f) VOR/LOC Mode Relay.

The VOR/LOC mode relay switches VOR power to a VOR circuit when the 51RV-2B is tuned to a VOR frequency, and ILS power to an ILS circuit

when the 51RV-2B is tuned to a localizer frequency. When in the ILS mode, +27.5 volts dc is brought out to the DPX rear connector bottom plug pin 36 (on rear of interconnect unit).

(3) 844A-1 VOR/LOC Instrumentation Planar Assembly.

(a) Primary VOR Instrumentation and Manual VOR Instrumentation.

The automatic or primary VOR instrumentation and the manual VOR instrumentation are series connected, thus providing complete fail-safe operation. The automatic VOR circuit provides an output to drive the RMI VOR bearing pointer for continuous VOR bearing. The manual VOR circuit provides VOR deviation and to/from outputs with respect to the pilot selected OBS setting. Unless both automatic and manual VOR circuits are operating properly, a VOR flag will show. A VOR flag will also come into view if the monitor VOR instrumentation channel is not operating properly. Proper operation provides a 2-kHz, square-wave signal from both primary and monitor VOR instrumentation channels to energize the flag logic circuit and remove the VOR flag from view.

(b) Monitor VOR Instrumentation Channel.

The monitor VOR channel is identical to the automatic channel and also provides a 2-kHz, square-wave signal to energize the flag when the two channels track. The reference and variable 30-Hz signals provide inputs to the VOR level and null sensor in the monitor channel. These inputs must be in quadrature or the VOR flag will show.

(c) Localizer Instrumentation and Manual VOR/LOC Sensor.

The localizer instrumentation circuit consists of primary and secondary channels. The audio output from the vhf NAV receiver is applied to the localizer instrumentation, which operates when the 51RV-2B is in the ILS mode (localizer frequency selected). The 90- and 150-Hz components are separated in dual channels.

Each channel provides a deviation output either to operate the VOR/LOC pointer (primary channel) or for comparison monitoring in the manual VOR/LOC sensor (primary and secondary channels). Level outputs from the primary channel are also monitored in the level sensor of the manual VOR/LOC sensor. Any unreliable signals will cause loss of flag signal, and the VOR/LOC flag will show.

(d) VOR/LOC Flag Logic, Driver, and Power Flag.

The VOR/LOC flag logic, driver, and power flag provides CCCS flag, high power flag, and low level flag outputs to retract VOR/LOC flags from view when the vhf NAV receiver and instrumentation are functioning properly.

(4) 951A-1 Glideslope Receiver Planar Assembly.

(a) UHF Synthesizer.

The inputs to the uhf synthesizer consist of the vhf output of the vhf synthesizer, the 50-kHz reference signal from the frequency standard in the vhf synthesizer, and binary coded decimal (BCD) control information. The uhf synthesizer produces the uniquely paired (with the localizer frequency) uhf glideslope injection frequencies for the glideslope receiver.

(b) UHF Tuner and IF. Circuits.

The uhf tuner and if. circuitry consist of a fixed, tuned, bandpass filter followed by if. amplifiers, a detector, and an agc circuit. The bandpass filter passes the frequency band 329.3 to 335.0 MHz. Injection from the uhf synthesizer through a tripler and into a first mixer provides a 30.1-MHz if. The 30.1-MHz if. is applied to the second mixer and if. amplifier to produce 500 kHz for detection. The resulting audio is applied as an input to the glideslope instrumentation.

(c) Glideslope Instrumentation and ILS Sensor.

The glideslope instrumentation circuit consists of primary and secondary channels. The audio output from the uhf tuner and if. circuit is applied to the glideslope instrumentation, which operates when the 51RV-2B is in the ILS mode. The 90- and 150-Hz components are separated in dual channels. The primary channel provides an output to operate the glideslope deviation pointer. Both channels produce deviation outputs for comparison monitoring in the ILS sensor. Rectified 90/150-Hz level outputs from the primary channel are monitored in the level sensor of the ILS sensor. Any unreliable signal from either the primary or secondary channel will cause loss of flag output, which causes the glideslope flags to show.

(d) Glideslope Flag Logic and Driver.

The glideslope flag logic and driver provides CCCS flag, high power flag, and low level flag outputs to retract glideslope flags from view when the glideslope receiver is functioning properly.

(5) Interconnect Unit.

With the interconnect unit connected to the 51RV-2B, the size of the unit conforms to ARINC Specification No. 404, 1/2 ATR short. The combined 51RV-2B and interconnect unit can be interchanged with the 51RV-1, provided the aircraft is wired for a 400-Hz system. The interconnect unit houses four mating connectors which mate with the Collins thin-line connectors on each planar assembly, and these vertical connectors are in turn connected to the DPX2 connector on the rear of the interconnect unit. The 51RV-2B DPX2 connector mates with the connector on the 390Y-1 Shockmount. A test connector on the interconnect unit provides access to various 51RV-2B functions as an aid in alignment and

troubleshooting. In addition to the preceding, the interconnect unit with Collins part number 772-0824-002 has the glideslope pointer bias connections deleted and is used with the 51RV-2B, Collins part number 777-1480-001.

(6) Controls. (Refer to figure 8.)

The dust cover that houses the 1051B-1 VHF NAV Receiver, 844A-1 VOR/LOC Instrumentation, and 951A-1 Glideslope Receiver Planar Assemblies is designed to provide access to most adjustable controls in the 51RV-2B. Three of the adjustable controls are accessible through holes on top of the dust cover. The removal of the 51RV-2B front panel exposes all other adjustment controls except those listed as internal. All variable capacitors, coils, and filters (in the vhf and uhf tuners) are considered as alignment components, and are not listed in figure 8.

The adjustable controls are listed in figure 8. Controls are listed by planar assemblies of the 51RV-2B.

CONTROL	LOCATION	FUNCTION
1051B-1 VHF NAV Receiver		
AUD LVL (R6)	External	Controls signal level applied to audio amplifier.
VOR TEST (S1)	Front panel	Initiates VOR self-test of 51RV-2B.
LOC BAL (R70)	External	Controls 90/150-Hz tone ratio of composite localizer self-test signal.
LOC LVL (R79)	External	Controls level of composite localizer test signal applied to vhf NAV receiver.
VHF DET (R9)	External	Controls output level of detected vhf signal.
UP/L (S2)	Front panel	Initiates ILS up/left self-test of 51RV-2B.
GS BAL (R75)	External	Controls 90/150-Hz tone ratio of composite glideslope self-test signal.
GS LVL (R78)	External	Controls level of composite glideslope test signal applied to glideslope receiver.
DN/R (S3)	Front panel	Initiates ILS down/right self-test of 51RV-2B.

51RV-2B Adjustment Controls (Sheet 1 of 4)
Figure 8

CONTROL	LOCATION	FUNCTION
VOR ZERO (R33)	External	Controls phase relationship between 30-Hz amplitude modulation and 30-Hz frequency modulation of 9960-Hz VOR self-test signal.
30 HZ LVL (R86)	External	Controls level of the 30-Hz signal which modulates the 9960-Hz multivibrator output.
900 FREQ (R5)	External	Controls the frequency of the 900-Hz multivibrator output.
9960 FREQ (R27)	External	Controls the frequency of the 9960-Hz multivibrator output.
20.2V (R14)	Internal	Controls output voltage of preregulator in +18- and +5-volt dc power supply.
18.0V (R29)	Internal	Controls output voltage of +18-volt dc regulator.
680T-1 VHF Synthesizer		
16-volt regulator (R1)	Internal	Controls output voltage of +16-volt dc regulator.
844A-1 VOR/LOC instrumentation		
Localizer circuit controls		
PRI CTR (R257)	External	Controls centering of the primary deviation level balance.
PRI SENS (R201)	External	Controls the primary deviation sensitivity.
SEC CTR (R260)	External	Controls centering of the secondary deviation level balance.
SEC SENS (R221)	External	Controls the secondary deviation sensitivity.

51RV-2B Adjustment Controls (Sheet 2 of 4)
Figure 8

CONTROL	LOCATION	FUNCTION
VOR circuit controls		
PRI ZERO (R14)	External	Calibrates automatic VOR channel for zero degree VOR bearing indication with a standard VOR test signal.
PRI TRACK (R166)	External	Controls azimuth tracking error of automatic VOR channel.
MON ZERO (R134)	External	Calibrates monitor VOR channel for zero-degree VOR bearing indication with a standard VOR test signal.
MON TRACK (R186)	External	Controls azimuth tracking error of automatic VOR channel.
SENS (R252)	External	Controls manual VOR primary and secondary deflection sensitivity.
BAL (R245)	External	Controls manual VOR primary and secondary deflection sensitivity balance.
RATE (R310)	External	Controls amount of rate feedback to servo amplifier.
Sensor circuit controls		
LOGIC DET (R40)	External (through top of dust cover)	Controls amplitude of 50-kHz signal used in manual VOR/LOC sensor.
GATE WID (R38)	External (through top of dust cover)	Controls manual VOR/LOC deviation difference sensor gate width.
FLAG THRESHOLD (R70)	External (through top of dust cover)	Controls manual VOR/LOC level sensor triggering threshold.
951A-1 Glideslope Receiver		
PRI SENS (R11)	External	Controls primary deviation sensitivity.
SEC SENS (R21)	External	Controls secondary deviation sensitivity.

51RV-2B Adjustment Controls (Sheet 3 of 4)
Figure 8

CONTROL	LOCATION	FUNCTION
PRI CTR (R41)	External	Controls centering of the primary deviation.
SEC CTR (R45)	External	Controls centering of the secondary deviation.
LOGIC DET (R40)	External	Controls amplitude of 50-kHz signal used in ILS sensor.
GATE WID (R38)	External	Controls amplitude of glideslope deviation difference sensor gate width.
FLAG THRESHOLD (R70)	External	Controls glideslope level sensor triggering threshold.

51RV-2B Adjustment Controls (Sheet 4 of 4)
Figure 8

5. THEORY OF OPERATION.

A. General.

The theory of operation includes ground facilities operation, 51RV-2B simplified block diagram theory, and the 51RV-2B detailed block diagram theory.

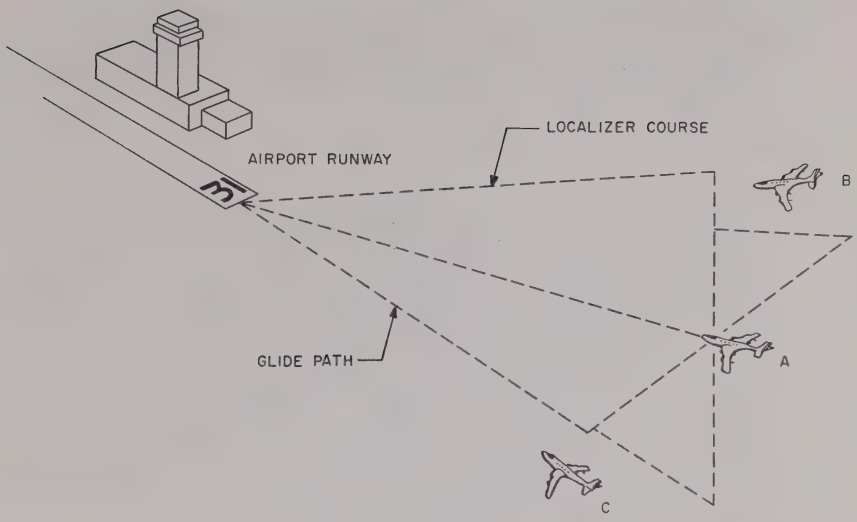
The 51RV-2B detailed block diagram theory is subdivided for each planar assembly (see paragraphs 5.D.(2) through 5.D.(5)). Paragraph 5.D.(1) discusses the general theory of operation of the 51RV-2B VOR/ILS Receiver, with emphasis on monitoring techniques.

B. Theory of Ground Facilities.

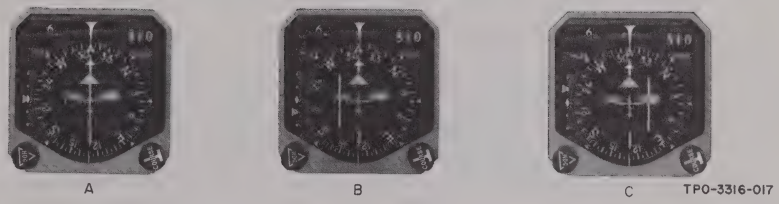
(1) ILS Principle.

(a) Radiation Pattern.

Two separate ground radio systems radiate the glideslope and localizer patterns by complex antenna arrays located near the airport runway. The glideslope signal (329.3 to 335.0 MHz) is radiated to produce effectively two intersecting lobes, one above the other. The upper lobe is predominantly modulated with 90 Hz, and the lower lobe is predominantly modulated with 150 Hz. On a line at an angle of 2.5 to 3 degrees from the ground, the two audio signals are equal. This line of equal modulation defines the glide path and is shown by the horizontal plane in figure 9. The 51RV-2B detects and compares the 90 and 150 Hz and applies outputs to the glideslope deviation



331A-6A COURSE INDICATOR



Localizer and Glideslope Operation, Pictorial Diagram
Figure 9

indicator and flag alarm on the course indicator. This provides vertical guidance for the pilot when making an approach to the runway. During an approach to the runway, the pilot receives horizontal guidance from the localizer deviation indicator and flag alarm on the course indicator. The 51RV-2B detects and compares two audio signals radiated by the localizer antenna array and provides an output to the course indicator. Two intersecting lobes are produced effectively, and each is directed along one side of the runway. The lobe to the left is predominantly modulated with 90 Hz,

and the lobe to the right is predominantly modulated with 150 Hz. The two audio signals are equal along a line bisecting the extended center line of the runway. The line of equal modulation defines the localizer course and is shown by the vertical plane in figure 9.

(b) ILS Operation. (Refer to figure 9.)

Audio signals of equal modulation are received and compared by the glideslope and localizer receivers when the aircraft is flying on the intersecting lines of the horizontal (glide path) and vertical (localizer) planes. The glideslope and localizer deviation indicators are centered by the receiver outputs as shown for the aircraft at position A. When the aircraft is to the right of the localizer course, a stronger 150-Hz signal will be detected, providing an output to deflect the localizer deviation needle to the left. The glideslope deviation needle will deflect down when the aircraft is above the glide path, where the 90-Hz signal is stronger. The instrument for the aircraft at position B illustrates these conditions. The localizer deviation needle will deflect to the right and the glideslope deviation needle will deflect up when the aircraft is at position C, where the localizer 90-Hz signal is stronger and the glideslope 150-Hz signal is stronger.

(2) VOR Principle.

(a) Sine Wave Comparison.

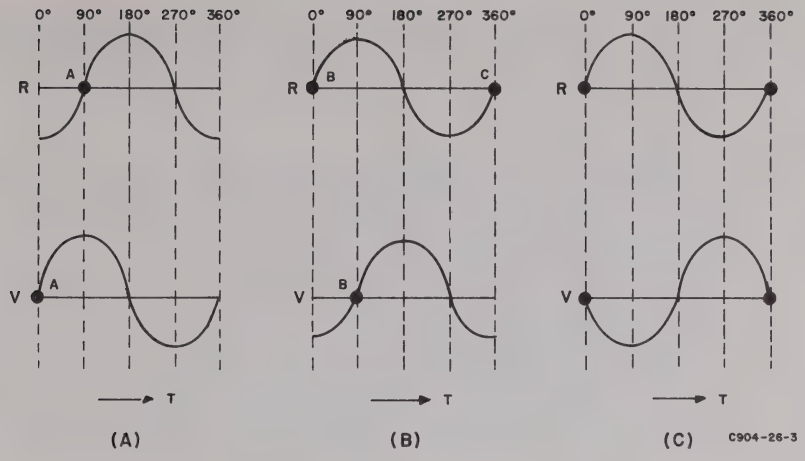
Sine waves will be used to illustrate the radiation of the VOR audio signals and to compare the phase differences of the two audio signals (30 Hz) in the 51RV-2B. Figure 10 illustrates how the phases of the audio signals are compared. At point (A) in figure 10, signal V passes through the reference line in a positive direction 90 degrees before signal R. In this condition, V is said to be leading R by 90 degrees.

Signal R is leading signal V by 90 degrees in figure 10(B) (note points B). If point C of signal R is compared with point B of signal V, signal R will be lagging by 270 degrees. From this comparison we note that one signal will lead another signal by an X number of degrees or lag by X + 180 degrees. The relationship will be determined by the points compared on the reference line. Figure 10(C) illustrates signals R and V when they are 180 degrees out of phase. Either signal is leading or lagging the other by 180 degrees.

(b) VOR Radiation Pattern.

1. General.

An understanding of the VOR ground radio system and radiation pattern will aid in understanding the operation of the 51RV-2B VOR circuits. The VOR system includes a ground station, an aircraft receiver, and associated instruments. VOR is an aircraft navigation aid that enables a pilot to determine the aircraft's bearing and azimuth as related to the ground station.



Sine Wave Comparison, Simplified Diagram
Figure 10

The principal of VOR navigation is phase comparison between a reference phase and a variable phase signal generated by the VOR transmitter and usually radiated by a 5-element antenna array. The phase difference is directly related to bearing. The VOR system is also used for communications. The ground station provides voice transmission and an identifying code to ensure that the desired VOR station is being monitored.

The VOR ground station transmits an infinite number of radials that can be received by the 51RV-2B. The deviation output of the receiver, proportional to the deviation from a selected radial, is applied to a course indicator. Additional receiver output signals energize to/from flag circuits that aid the pilot in determining whether the aircraft is flying to or from the ground station as related to the selected radial.

2. Reference Phase Signal.

The reference phase signal includes an rf carrier and a 9960-Hz subcarrier. The subcarrier is frequency modulated between 10,440 Hz and 9480 Hz at a rate of 30 Hz. The reference phase signal is radiated from the center antenna of the 5-element antenna array. This signal is omnidirectional and has a constant phase throughout 360 degrees of azimuth. When voice communication or station identification is transmitted, the FM subcarrier of the reference phase signal is amplitude modulated.

3. Variable Phase Signal.

The variable phase signal is a pure rf carrier. This signal is radiated by the diagonal antennas of the 5-element array. The field strength pattern

is a figure eight configuration that is rotated through 360 degrees of azimuth at a rate of 1800 r/min. The phase of the signal varies directly with azimuth.

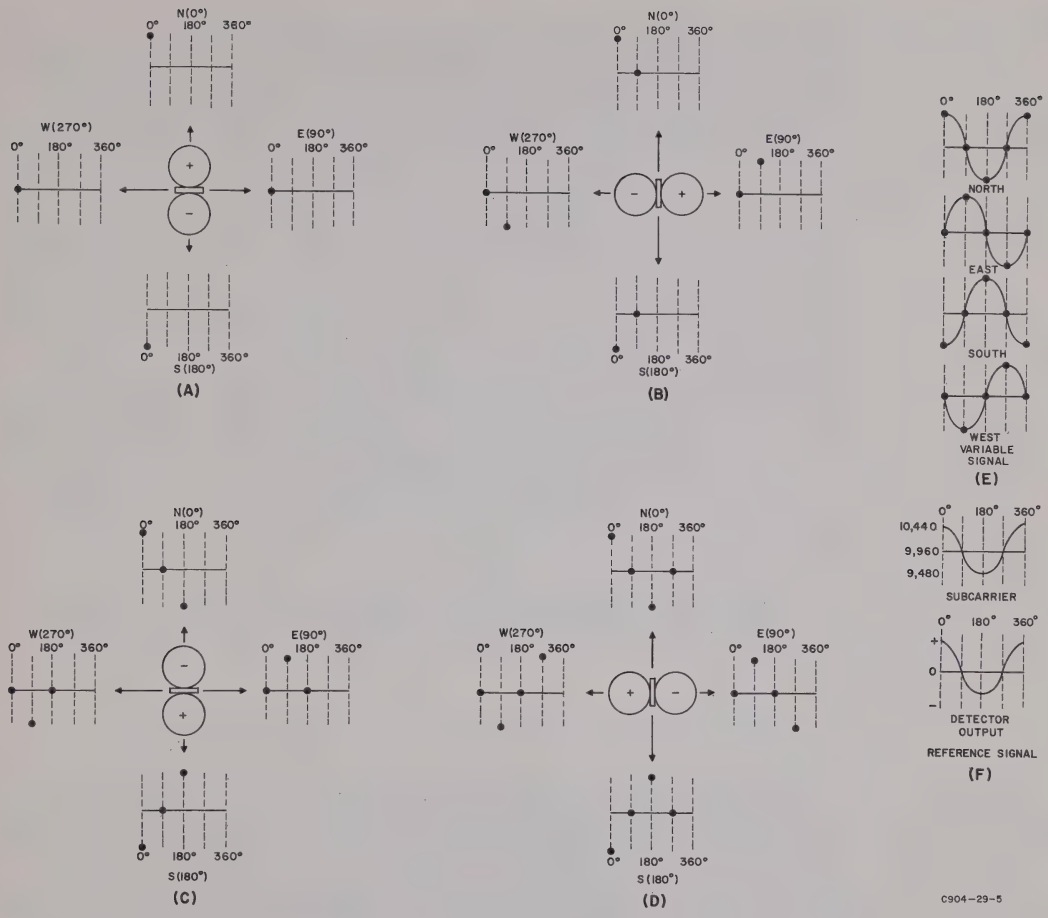
4. Composite Signal.

The reference phase signal and the variable phase signal are in phase when the positive lobe of the figure eight pattern is aligned with magnetic north. However, as the positive lobe of the variable phase signal is rotated through 360 degrees, the phase angle between the reference phase signal and the variable phase signal increases. When the variable phase signal is aligned other than magnetic north, the positive voltage maxima of the variable phase signal occurs at a given time later than the positive voltage maxima of the reference signal. The phase displacement in the 2-voltage maxima at any point in azimuth designates the bearing at that point. The difference in phase can be measured and indicated by instrumentation in the aircraft. Therefore, a radial can be selected, and the aircraft's flight path can be related to that selected radial.

The figure eight pattern reinforces the omnidirectional field strength pattern on the in-phase side and weakens the field strength on the out-of-phase side. The resultant field strength pattern is cardioid revolving at a rate of 30 r/s. As a result of the space modulation of the rotating cardioid, an additional 30-Hz signal is apparent at the receiver input. The receiver circuit detects what appears to be a 30-Hz frequency-modulated signal with a 30-Hz amplitude-modulated component. The phase of the two 30-Hz signals are compared, and the signal output is proportional to the phase relationship of the two 30-Hz signals.

5. VOR Signal Generation. (Refer to figure 11.)

The variable 30-Hz signal is obtained by transferring the rf carrier to a dipole antenna and rotating the antenna at a rate of 1,800 r/min (30 r/s). The radiation field of a dipole is a figure eight with the lobes 180 degrees out of phase. The field strengths at four directions (90-degree locations) from the antenna will be as shown by the black dots in figure 11(A) for one position of the dipole antenna. The relative strength of the radiated rf field is shown for this position, indicating maximum strength at 0 degree (north), minimum strength at 180 degrees (south), and an average strength (on reference line) at 90 and 270 degrees (east and west). The dots indicating field strength are placed on a graph depicting time versus signal strength. Vertical lines are added along the time axis to illustrate time for one-quarter cycle (90 degrees). Figure 11(B) illustrates the field strength with the dipole antenna rotated clockwise 90 degrees from the position shown in figure 11(A) (one-quarter turn). Relative strength at the north and south locations are now average and are shown on the graph at a time 90 degrees later. Maximum signal strength is plotted at 90 degrees (east), and minimum signal strength is plotted at 270 degrees (west). The field strength plotted in figure 11(C) is for the pattern of the dipole antenna rotated another 90 degrees (180 degrees from the position shown in figure 11(A)). The average signal strength is plotted on the



VOR Radiation Patterns, Simplified Diagram
Figure 11

reference line at 90 and 270 degrees (at a time 180 degrees later), maximum positive signal strength is plotted at 180 degrees (south), and maximum negative signal strength is plotted at 0 degree (north). The field strength plotted in figure 11(D) is shown for the antenna rotated another 90 degrees (270 degrees from the position in figure 11(A)). When the antenna has been rotated 360 degrees, the signal strengths will be the same as those shown in figure 11(A) and advanced 360 degrees along the time axis. Figure 11(E) illustrates the voltage waveform of the signal strength plots at each direction from the station.

Since the dipole antenna is rotated at a rate of 1,800 r/min (30 r/s), these signal strengths (figure 11(E)) will vary at a 30-Hz rate and effectively amplitude-modulate the rf carrier. Note that the 30-Hz signal located 90 degrees from the VOR station lags the signal at the 0-degree location by 90 degrees. The phase of the signal continues to lag the signal north of the station by the number of degrees equal to the bearing from the station.

The phasing of the reference and variable signals is adjusted so they are in phase at magnetic north. The frequency of the 9960-Hz subcarrier is frequency modulated between 9480 and 10,440 Hz at a 30-Hz rate and is synchronized with the rotation of the dipole antenna. When the frequency of the subcarrier is 10,440 Hz, the positive lobe of the dipole antenna is pointed toward magnetic north. The subcarrier frequency decreases to 9480 Hz as the dipole antenna rotates clockwise to 180 degrees (south). At 90 and 270 degrees from north (0 degree), the subcarrier frequency is 9960 Hz. A maximum positive audio modulating voltage produces 10,440 Hz, and a maximum negative voltage produces 9480 Hz. Thus the output of an FM detector will be positive when the frequency is 10,440 Hz and negative when the frequency is 9480 Hz. The frequency of this voltage will be equal to the rate the subcarrier frequency is varying, which is 30 Hz.

The subcarrier frequency and the output voltage from an FM discriminator is shown in figure 11(F) for one cycle (one revolution of dipole antenna).

(c) VOR Operation.

1. General.

It was illustrated in the preceding paragraph that the phase angle between the reference and variable signals is a measure of the bearing of the aircraft from the VOR station. The 51RV-2B VOR instrumentation circuit measures this phase angle by providing a means to shift the reference signal after it has been demodulated from the 9960-Hz subcarrier. If it were practical to determine when two signals were in phase, the phase angle could be determined by shifting the reference signal until it was exactly in phase with the variable signal. Then the amount the reference signal was shifted would be a measure of the bearing from the station and could be indicated on any scale or dial coupled to the phase-shifting device. Since it is much simpler to determine when two signals are 90 degrees out of phase, the reference signal is shifted an amount equal to the variable signal plus 90 degrees. The scale or dial is coupled to the phase-shifting device in such a manner that the extra 90 degrees of phase shift is not indicated.

2. Automatic VOR Operation.

Automatic VOR operation is the term given when the 30-Hz reference signal is shifted automatically to measure the phase angle between the variable 30 Hz and reference 30 Hz. The phase difference between the

reference and variable signals is detected in a phase detector. The phase detector output is converted to an ac voltage and amplified to drive a bearing mechanism motor. The motor turns the variable phase shifter and a synchro, which drives an RMI pointer. The motor will turn until it has shifted the reference signal in the phase shifter to obtain a 90-degree phase relationship with the variable signal in the VOR phase detector. At this time the phase detector output will be zero, and the motor will stop, positioning the RMI pointer at the bearing to the VOR station. A continuous indication of the bearing to the VOR station will be shown on the RMI.

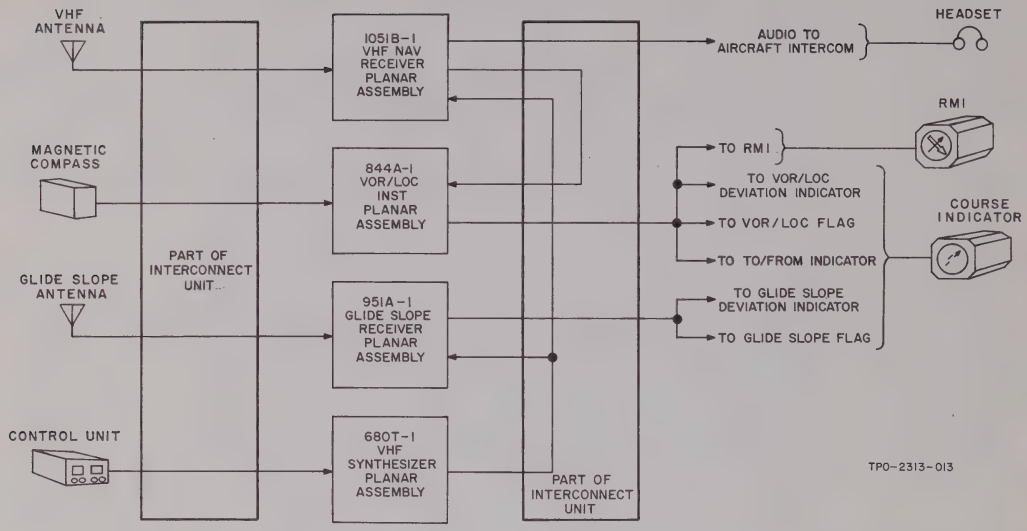
3. Manual VOR Operation.

Manual VOR operation is the term used to describe operation of an omnibearing selector (OBS) in the external course indicator by the pilot. The VOR bearing mechanism motor rotates a 400-Hz resolver. Power is applied to the rotor of the resolver, inducing a voltage in the stators. This voltage is applied to the stator of a resolver in the external course indicator. The angular position of the rotor of this resolver is selected by the pilot when entering a course on the course indicator or OBS. If the course selected in the course indicator corresponds with the VOR bearing set by the motor shaft, the voltage induced in one of the resolver rotors of the course indicator will be zero volt, and the deviation indicator will provide an on-course indication. If the course selected in the course indicator does not correspond with the VOR bearing set by the motor shaft, the deviation indicator will provide the appropriate left or right indication.

C. 51RV-2B Simplified Block Diagram Theory. (Refer to figure 12.)

The 51RV-2B VOR/ILS Receiver consists of a 1051B-1 VHF NAV Receiver Planar Assembly, 844A-1 VOR/LOC Instrumentation Planar Assembly, 951A-1 Glideslope Receiver Planar Assembly, 680T-1 VHF Synthesizer Planar Assembly, and an interconnect unit. All interconnecting between the 51RV-2B planar assemblies is provided by the interconnect unit. The interconnecting between planar assemblies is accomplished by wiring from the pin on the mated vertical connector of one planar assembly to the appropriate pin on the mated vertical connector of another planar assembly. This wiring is contained inside the interconnect unit, which houses the four mating vertical connectors. All inputs to the planar assemblies and outputs from the planar assemblies are applied through the rear connector of the interconnect unit.

The 680T-1 VHF Synthesizer provides tuning voltages and injection frequencies to the 1051B-1 VHF NAV Receiver, and BCD information, injection frequencies and a 50-kHz reference signal to the uhf synthesizer in the 951A-1 Glideslope Receiver. The 1051B-1 VHF NAV Receiver processes VOR and localizer rf to produce audio for the 844A-1 VOR/LOC Instrumentation and audio for an aural output. The 844A-1 VOR/LOC Instrumentation processes the detected audio from the 1051B-1 VHF NAV Receiver and applies a VOR/LOC deviation output to the course indicator, a VOR/LOC low-level and high power flag output to the course indicator, a continuous VOR bearing output to the RMI, and a to/from output to the course indicator. The 951A-1 Glideslope Receiver processes incoming glideslope rf and applies a glideslope deviation output and a low-level and high power flag output to the course



51RV-2B VOR/ILS Receiver, Simplified Block Diagram
Figure 12

indicator. VOR/LOC and glideslope deviation and flag outputs are also available for use with an automatic flight control system. The VOR circuit is energized when the 51RV-2B is in VOR mode (108.00 to 117.95 MHz except odd-tenths MHz from 108.10 to 111.90 MHz). Localizer and glideslope circuits are energized when the 51RV-2B is in ILS mode (odd-tenths MHz from 108.10 to 111.90 MHz).

D. 51RV-2B Detailed Block Diagram Theory.

(1) General.

The 51RV-2B VOR/ILS Receiver provides manual and automatic VOR, localizer, and glideslope functions. The ILS accuracy monitoring capability of the 51RV-2B meets all stated or anticipated category III landing requirements. In addition to ILS monitoring, extensive and thorough VOR monitoring, including accuracy monitoring, is incorporated within the 51RV-2B.

The 51RV-2B employs 2-out-of-5 binary switching for frequency selection. The ARINC 2-out-of-5 information is converted to binary coded decimal (BCD) information in a portion of the vhf synthesizer planar assembly circuit and is then applied to the vhf synthesizer offset control logic. The digitally stabilized frequency synthesizer uses only one crystal to provide all of the required injection frequencies. Glideslope and localizer pairing is accomplished automatically. The 51RV-2B provides 180 VOR channels with 50-kHz spacing in the frequency range 108.00 to 117.95 MHz, excluding odd tenths of megahertz in the 108.10- to

111.90-MHz frequency range. Twenty localizer channels are provided at odd tenths of megahertz in the 108.10- to 111.90-MHz frequency range. Twenty glideslope channels are available with 300-kHz spacing from 329.3 to 335.0 MHz.

The detected audio from the receivers is processed in the respective instrumentation circuit to provide VOR/LOC and glideslope deviation signals, flag outputs, to/from outputs, and an aural output. A continuous VOR bearing input to one of the RMI pointers is provided by the automatic VOR instrumentation. Magnetic heading information from the magnetic compass is amplified in the RMI servo amplifier to drive the RMI compass card. An output representing aircraft deviation (on-course, right, or left) from a pilot-selected VOR bearing is provided by the manual VOR instrumentation. This output operates a VOR deviation bar in the course indicator.

The 51RV-2B VOR/ILS Receiver utilizes dual instrumentation channels with comparison to provide accuracy monitoring. The glideslope, manual VOR, and localizer instrumentation circuits each have primary and secondary channels which are identical to each other. The primary and secondary channels of the glideslope instrumentation circuit are identical to the primary and secondary channels of the localizer instrumentation circuit. The VOR primary channel, contains the automatic VOR instrumentation, and is monitored by an identical VOR monitor channel.

The ILS deviation outputs required to drive the deviation bars in the course indicator are taken from the glideslope and the localizer primary channels. The VOR deviation output is taken from the VOR primary channel deviation discriminator in the manual VOR instrumentation.

The deviation output of the glideslope primary channel is applied as an input to a comparator in the ILS sensor. The deviation output of the localizer primary channel is applied as an input to a comparator in the manual VOR/LOC sensor. The ILS sensor, like the manual VOR/LOC sensor, consists of level sensor, comparator, and threshold modifier. The ILS sensor is identical to the manual VOR/LOC sensor.

The secondary channels in the glideslope and localizer instrumentation unit also provide deviation outputs to the respective sensors. These secondary channel deviation outputs are not applied to the course indicator but are used only for comparison.

The primary channel in the glideslope instrumentation unit also provides two dc level outputs. One of the level outputs is a rectified 90-Hz signal and the other level output is a rectified 150-Hz signal. Each of the level outputs is applied to the level sensor in the ILS sensor.

The primary channel in the localizer instrumentation unit also provides rectified 90- and 150-Hz level outputs to the level sensor in the manual VOR/LOC sensor.

The ILS sensor, like the manual VOR/LOC sensor will provide a 2-kHz output to the respective flag logic circuit when both the level outputs and the deviation outputs are reliable. Any component failure in either the ILS sensor or VOR/

LOC sensor will cause loss of the 2-kHz flag signal, and the respective glide-slope or VOR/LOC flag will show.

The VOR primary channel consists of automatic VOR instrumentation. The manual VOR instrumentation circuit includes primary and secondary deviation discriminators and a to/from discriminator. A continuous VOR bearing output to the RMI is provided by the differential synchro in the automatic instrumentation. This servo motor also drives a 400-Hz resolver in the manual VOR instrumentation. This 400-Hz resolver is electrically coupled to the resolver in the course indicator. The omnibearing selector (OBS) is mechanically coupled to the course indicator resolver. If the OBS setting corresponds to the VOR bearing set by the motor shaft, the resolver in the course indicator will not apply voltages to the deviation discriminators in the manual VOR instrumentation. The VOR deviation output from the primary deviation discriminator in the manual VOR instrumentation will center the deviation needle for an on-course indication. If the OBS setting does not correspond to the VOR bearing, the resolver in the course indicator will apply voltages to the deviation discriminators in the manual VOR instrumentation. The primary deviation discriminator output will drive the deviation bar to the correct left or right indication.

An output from the to/from discriminator is applied to the to/from indicator. The to/from ambiguity indicator indicates whether the deviation to the VOR station is within the semicircle centered about the radial selected on the course selector (OBS) or within the semicircle centered about the reciprocal of the selected course direction. If the station direction is within 90 degrees of the selected radial, a "to" indication appears. If the station direction is within 90 degrees of the reciprocal of the selected radial, a "from" indication appears.

The VOR primary and secondary deviation discriminators in the manual VOR instrumentation circuit provide deviation outputs that correspond to the outputs of the deviation discriminators in the localizer instrumentation circuit. The outputs from the VOR discriminators are applied to the manual VOR/LOC sensor to provide complete monitoring of the primary VOR instrumentation. To complete the fail-safe VOR monitoring, a monitor VOR channel identical to the primary VOR channel is provided. This monitor channel does not provide deviation outputs. The VOR monitor channel functions only as a monitor to check the operation of the VOR primary channel. If either the VOR primary or monitor channel fails, the VOR/LOC flag will come into view.

(2) 680T-1 VHF Synthesizer Planar Assembly, Block Diagram Theory

(a) General. (Refer to figure 13.)

The vhf synthesizer is capable of supplying output frequencies in the 116.000- through 135.975-MHz range in 25-kHz increments.

In the 51RV-2B, the vhf synthesizer supplies a 126.00- to 135.95-MHz output to the VOR/LOC receiver, thereby reducing the incoming rf (108.00 to 117.95 MHz) to the first if. 18-kHz difference frequency. The VOR/LOC receiver 50-kHz channel spacing requires the vhf synthesizer injection frequencies to be selectable at 50-kHz intervals. The vhf synthesizer injection

frequency (126.1 to 129.9 MHz) applied to the uhf synthesizer is selected at 100-kHz intervals.

The accuracy and stability of each output frequency is equal to that of the crystal oscillator output in the frequency standard. A digitally stabilized master oscillator provides these output frequencies.

The vhf synthesizer in the 51RV-2B incorporates circuits which convert the 2-out-of-5 frequency information to binary coded decimal (BCD) information.

(b) Power Sources. (Refer to figure 13.)

The required +5- and +18-volt dc power is supplied directly from the +18/5-volt dc regulator in the vhf NAV receiver planar assembly. The +18-volt dc output from this regulator is applied to the +16-volt dc regulator in the vhf synthesizer. This regulator provides the +16 volts required for operation of the remaining circuits in the vhf synthesizer.

(c) Frequency Standard. (Refer to figure 13.)

The frequency standard consists of a temperature-compensated crystal oscillator (tcxo), buffer amplifiers, and a divider network. The (tcxo) consists of a 3.2-MHz, crystal-controlled oscillator and a temperature compensation network. The 3.2-MHz output is applied to the divider network through buffer amplifier Z5Q2 and pulse shaper Z4Q1. The divider network supplies two 25-kHz reference outputs (200-nanosecond and 5-microsecond pulse widths) to the vhf synthesizer and a 50-kHz reference output to the 51RV-2B uhf synthesizer.

(d) Synthesizer Operation. (Refer to figure 13.)

The operating frequency of the vcmo (vhf synthesizer rf output) is determined by a tuning voltage that is applied to voltage variable capacitors in the vcmo tuned circuit. This tuning voltage is supplied from an adder stage through a low-pass filter. Tuning voltage outputs from two phase-locked loops are combined in this adder. The tuning voltage from the 1-MHz phase-locked loop controls the vcmo operating frequency in 1-MHz increments. while the tuning voltage from the 25-kHz loop controls the operating frequency in 25-kHz increments.

Voltage-controlled oscillator (vco) Z43Q1, Z43Q2 provides the operating frequency for the 1-MHz phase-locked loop. Its output is supplied through buffer-amplifier Z40Q1 and pulse shapers Z6Q9 through Z6Q10 to a fixed divider. This network divides the vco output by 20. The output of the divide-by-20 network is supplied to the variable counter. The division ratio of this counter can be one of 20 ratios from 103 to 122. The division ratio is determinted by information on the 1- and 10-MHz tuning wires. The variable counter output frequency is compared in a flip-flop phase detector with the 25-kHz reference frequency. The phase detector output is supplied to limiter-amplifiers Z6Q6 through Z6Q8. This stage supplies a tuning voltage through a low-pass filter to voltage variable capacitors in the vco tuned circuit.

When the two divider networks reduce the vco output frequency to 25 kHz, the phase detector supplies a tuning voltage that locks (holds) the vco on this frequency. This tuning voltage is also supplied through the adder network and low-pass filter to the vcmo tuned circuit. Since the division ratio of the counter is changed by 1 for each 1-MHz change in frequency information, the vcmo output frequency is changed in 1-MHz increments. The vco operating frequency is changed in 0.5-MHz increments.

NOTE: When the variable counter provides a division ratio of 103, the vco output is 51.5 MHz.

$$\left[\frac{(51,500\ \text{kHz})}{(20)\quad(103)} \quad \text{equals } 25\ \text{kHz}\right]$$

Then if the division ratio is increased to 104, the vco output will be 52.0 MHz.

The vco output is also supplied through buffer-multipliers Z38Q1 through Z39Q1 to mixer Z9Q1. The multiplier doubles the vco frequency. Therefore, the input to the mixer, that is derived from the vco, is in 1-MHz increments. The other input to the mixer is supplied from the vcmo through four buffer-amplifiers (Z34Q1, Z35Q1, Z36Q1, and Z37Q1). Both inputs to the mixer change in 1-MHz increments; therefore, the whole-megahertz difference between the mixer inputs is always the same.

The mixer output, in the 13.000- through 13.975-MHz range, is the operating frequency for the 25-kHz phase-locked loop. This output is supplied through a low-pass filter and pulse shaper stages (Z9Q2 through Z9Q4) to the variable counter. The division ratio of this counter can be one of 40 ratios from 520 to 559. This division ratio is determined by the information on the 25- and 100-kHz tuning wires. The variable counter output is compared with the 25-kHz reference in frequency and phase detectors. These detectors supply outputs through the loop control ANDing network to limiter-amplifiers Z9Q14 through Z9Q15. The limiter-amplifier supplies a tuning voltage through the adder network and low-pass filter to the vcmo. When the mixer output is reduced to 25-kHz by the variable counter, this tuning voltage locks the vcmo to the correct 25-kHz increment.

A frequency detector is used in the 25-kHz loop, in addition to the phase detector, to provide the tuning voltage. Its output prevents the vcmo from being locked to a spurious mode when the frequency error is large. When the variable counter output is not 25 kHz, the frequency detector supplies outputs through the pulse stretcher stages to the fault monitor detector which produces an output to set the flip-flop phase detector. The outputs from the pulse stretchers also enable the high- or the low-frequency switch. If the frequency (from variable counter) is high, the high-frequency switch is enabled. The 25-kHz reference signal is supplied through this switch and the loop control ANDing network to limiter-amplifiers Z9Q14 through Z9Q15. A tuning voltage is produced to decrease the vcmo operating frequency. When the vcmo frequency is decreased so that the variable counter output is 25 kHz, the frequency detector provides outputs to disable both

low- and high-frequency switches. The fault monitor detector now provides an output to enable the flip-flop phase detector (remove set control). The phase detector now supplies an output through the loop control ANDing network to provide the tuning voltage. Its output will lock (hold) the vcmo to the correct operating frequency.

The low-frequency switch is enabled when the variable counter output is lower than 25 kHz. The 25-kHz reference signal is now supplied through the low-frequency switch, and the loop control ANDing network to limiter amplifiers Z9Q14 through Z9Q15. This switch inverts the 25-kHz signal to change its duty factor, providing a tuning voltage which causes an increase in the vcmo operating frequency.

When the variable counter is not 25 kHz, the fault monitor detector supplies an output to enable loop response control Z9Q13. This stage changes the response of the loop to slow down loop operation when the tuning voltage is causing a change in the vcmo operating frequency.

Lock indicator Z9Q6 supplies an output to power amplifier control Z41Q3, providing a signal to turn on or disable power amplifier Z2Q1. When either phase-locked loop is not operating at the proper frequency, the respective fault monitor detector supplies a warning output to lock indicator Z9Q6. The loss-of-signal detector supplies a warning to Z9Q6 when either the 25-kHz reference signal or the 25-kHz loop signal is lost. When Z9Q6 receives a warning from one of these three sources, it provides an output which causes power amplifier Z2Q1 to be disabled.

Information from frequency control wires is applied to the phase detector sensitivity control. This sensitivity control provides a means to vary the supply voltage for the limiter-amplifier stages in both 25- and 1-MHz loops. Thus, the phase detector sensitivity can be varied in four bands for the low range, providing maximum sensitivity at the high-frequency end, where the sensitivity of the voltage variable capacitors is lowest.

(3) 1051B-1 VHF NAV Receiver Planar Assembly, Block Diagram Theory.

(a) VHF Tuner and IF. Circuits. (Refer to figure 14.)

The vhf antenna input is applied to a 3-pole, minimum loss, rf tuned filter which is tuned by a dc tuning voltage applied from the vhf synthesizer to voltage variable capacitors in the filter. The output of the rf filter is applied to field-effect transistor (fet) first mixer Z8Q1 and Z8Q2, where it is mixed with the 126.00- to 135.95-MHz injection output of the vhf synthesizer. The difference signal is applied to 18-MHz crystal filter FL1. The 18-MHz output of FL1 is coupled through LC matching network L1, C1 to agc-controlled amplifiers Z7Q1 and Z7Q2 to produce an 18-MHz if. output.

The 18-MHz if. is applied to second mixer Z7Q4 where it is mixed with the 18.4985-MHz injection from local oscillator Z7Q3. At the mixer output is fixed tuned bandpass filter FL2 tuned to 498.5 kHz. Following the filter is 3-stage, RC-coupled, 498.5-kHz if. amplifier Z3Q1, Z3Q2, and Z3Q3. This 3-stage if. amplifier increases the signal to the desired level. The

498.5-kHz if. amplifier output is transformer coupled to detector Z3CR1. The detected audio from Z3CR1 is applied to isolation amplifiers Z3Q4 and Z3Q5. Isolation amplifiers Z3Q4 and Z3Q5 provide audio for the audio amplifier, audio for the VOR and the localizer instrumentation units, and an input to the agc circuit.

The agc reference is provided by division of +18 volts dc by Z3R31 and Z3R32. When the detected rf from detector Z3CR1 decreases, the agc differential amplifier (Z3Q6, Z3Q7, Z3Q10, Z3Q11) provides an output through agc output amplifier Z3Q8 to increase the gain of the if. amplifiers. When the detected rf from detector Z3CR1 increases, the agc differential amplifier provides an output through agc output amplifier Z3Q8 to decrease the gain of the if. amplifiers.

A NAV disable input is applied to disable the agc output amplifier whenever the 51RV-2B is tuned to a frequency other than a NAV frequency. The NAV disable input is inverted by Z1Q2 and applied to if. disable Z1Q4 and tuning voltage disable Z1Q3. If. disable Z1Q4 saturates and grounds the agc reference level causing loss of agc and disabling the if. stages. Tuning voltage disable Z1Q3 also saturates and the dc tuning voltage applied from the vhf synthesizer is applied to ground.

(b) Audio Amplifier Z5. (Refer to figure 14.)

The amplified output from the vhf NAV receiver detector is applied to input emitter follower Q1 in the audio amplifier for power gain and minimum loading of the vhf NAV receiver detector. From this input amplifier, the audio signal is applied to the response shaping network and audio amplifiers.

Audio bandpass filter FL1 shapes the response by attenuating 90- and 150-Hz localizer signals and the 9960-Hz subcarrier on VOR. The output from the bandpass filter, containing frequencies exclusive of VOR/LOC frequencies, is applied to audio amplifiers Q2 and Q3 and a phase splitter network containing Q4. PA drivers Q5 and Q6 apply the output to a push-pull output stage consisting of Q7 and Q8. The output amplifiers bring the 51RV-2B VOR/ILS Receiver aural output up to the required power level for the aircraft intercom system.

(c) VOR/ILS Audio Test Generator and Timer Z2. (Refer to figure 14.)

A self-test generator provides simulated VOR, localizer, and glideslope audio signals to modulate the VOR/LOC rf self-test oscillator in the vhf NAV receiver planar assembly and the glideslope rf self-test oscillator in the glideslope receiver planar assembly. Sine wave, phase-locked, 30-Hz, and 9960-Hz frequency, modulated at 30-Hz signals are required in the VOR test mode. A 900-Hz audio signal is also provided for checking the audio amplifier stage in the vhf NAV receiver. Square-wave, phase-locked 90- and 150-Hz signals are required in the ILS test mode.

Assume that the 51RV-2B is in ILS mode (LOC frequency selected). This condition permits operation of ILS self-tests. The DN/R and UP/L push-button test switches on the 51RV-2B front panel or the remote DN/R and

UP/L test switches on the cockpit control unit initiate the respective ILS tests when actuated. Upon initiating an ILS test, the VOR/LOC and glideslope flags drop into view for approximately 3 seconds and then are retracted for 20 seconds. The glideslope pointer shows a predetermined up (up/left test) or down (down/right test) indication, and the VOR/LOC deviation bar shows a predetermined left (up/left test) or right (down/right test) indication (75 ua or 2-1/2 dots). If after 20 seconds the test initiate signal remains (test switch still actuated), the VOR/LOC and glideslope flags return to view, thereby preventing the pilot from flying on test commands should failure occur. Also, all of the 51RV-2B monitoring circuits are functioning normally during self-test. Any malfunction or failure that occurs during the 20-second self-test period will cause the respective VOR/LOC or glideslope flag(s) to come into view.

With the 51RV-2B tuned to an ILS frequency, the VOR/LOC mode relay is energized. ILS power is switched to all ILS circuits and +18 volts dc is switched to ILS circuits in the test generator and timer. This dc ILS input is applied to test request initiate Q15, down/right test Q16, up/left test Q17, and to the timer enable ORing circuit. As long as no ILS test switch is actuated, the output of the timer enable ORing circuit inhibits operation of 3-second timer Q11 and transistors Q15-Q17 remain saturated. Upon actuating either a DN/R or UP/L test initiate switch, a ground is applied to the cathode of CR16 or CR17 respectively. The dc ILS input is removed, thereby inhibiting test request initiate Q15 and Q16 (DN/R test switch engaged) or Q17 (UP/L test switch engaged). Down/right test Q16 and up/left test Q17 apply outputs to the glideslope/localizer combiner. These two inputs to the glideslope/localizer combiner place the combiner in a down/right test configuration or up/left test configuration respectively. The output of the timer enable ORing circuit is also removed when one of the ILS test initiate switches is engaged. Three-second timer operation begins.

Assuming the 51RV-2B to be in VOR mode (VOR frequency selected), a VOR test is initiated by actuating the VOR test switch on the 51RV-2B front panel or the remote VOR test initiate switch on the remote control unit. Upon initiating a VOR test, the VOR/LOC flag drops into view for 3 seconds and up to 9 seconds (depending on the slew time of the RMI). The RMI pointer rotates to 180 degrees, and the VOR/LOC deviation indicator is centered. The VOR/LOC flag will return to view, if, after 14 to 20 seconds, the test initiate signal remains.

With the 51RV-2B tuned to a VOR frequency, the VOR/LOC mode relay is unenergized. VOR power is switched to all VOR circuits and +18 volts dc is switched to VOR circuits in the test generator and timer. This dc VOR input is applied to test request initiate Q15 and to the timer enable ORing circuit. As long as no VOR test switch is actuated, the output of the timer enable ORing circuit inhibits operation of 3-second timer Q11 and test request initiate Q15 remains saturated. When a VOR test switch is actuated, VOR timer enable CR18 is forward biased and the +18 volts dc VOR is removed to ground. The output of the timer enable ORing circuit is removed causing the 3-second timer to begin operating. Test request initiate Q15 is inhibited allowing 20-second timer Q14 to control flag enable Q13.

Assume that a test switch is actuated. With test request initiate Q15 inhibited, the base and collector voltage of flag enable transistor Q13 are equal, and Q13 is inhibited. The flag enable output from flag enable Q13 to the glideslope flag logic and driver and the VOR/LOC flag logic and driver is removed, causing the respective flags to show. Loss of output from the timer enable ORing circuit causes capacitor discharge in the 3-second timer network. After 3 seconds of discharge, the bias voltage on transistor Q11 enables 3-second timer Q11. The voltage developed across the output load of Q11 enables test enable control Q10 which enables test enable Q9. The test enable +18-volt dc output is applied to 20-second timer Q14 and to the 900-Hz multivibrator. The test enable signal disables 20-second timer Q14 for a 20-second interval. When Q14 is disabled, the base voltage on flag enable Q13 drops, thereby enabling Q13 and replacing the flag enable signal. This flag enable signal is applied to the 3-second timer network, holding the timer off when a test is not initiated and working in conjunction with a 3-second timer hold switch Q15 to hold the 3-second timer on during test. If, after 20 seconds, the test initiate signal remains, Q14 again saturates and flag enable Q13 is again inhibited, removing the flag enable signal and returning the flags to view.

The test enable +18 volts dc applied to the 900-Hz multivibrator starts oscillation of the astable multivibrator which supplies a 900-Hz output to three counter networks. Counter A1 divides the 900-Hz input by six to produce a 150-Hz square wave. Counter A2 works with counter A7 to produce a 90-Hz square wave, and also works with counter A3 to produce a 30-Hz square wave. The square-wave output of counter A3 is differentiated and applied to sync trigger A11. The output of sync trigger A11 synchronizes the 150-Hz square-wave output and 90-Hz square-wave output to the 30-Hz square-wave output.

The 150-, 90-, and 30-Hz signals are applied to inverter network A12. This inverter network prevents loading of the counters.

The three output signals are amplified in amplifiers Q3, Q4, and Q5. The 90- and 150-Hz square waves are combined in the glideslope/localizer combiner to form the up/left or down/right ILS test signals. The self-test glideslope audio is applied to the glideslope receiver self-test oscillator/modulator directly from the combiner. The self-test localizer audio is applied through CR25 (CR26 is reverse biased by +18 volts dc ILS) to the VOR/LOC receiver self-test oscillator/modulator.

The 30-Hz VOR signal is synthesized in the RC combiner from the 30-, 90-, and 150-Hz square waves used in the ILS mode. The 30 Hz is applied to modulator Q6, which drives 9960-Hz multivibrator Q7 and Q8. The VOR signal output from the 9960-Hz multivibrator is a frequency-modulated signal with a 30-Hz amplitude modulation component. This signal obtains a 900-Hz audio component from 900-Hz amplifier Q18 and is then applied through CR26 (CR25 is reverse biased by +18 volts dc VOR) to the self-test oscillator/modulator in the vhf NAV receiver.

(d) RMI Servo Amplifier Z4. (Refer to figure 14.)

The RMI servo amplifier steps up magnetic heading information from the magnetic compass system to a level sufficient to drive the RMI compass card. Input C' is applied to the secondary of rate feedback transformer T1 and coupled through to the base of driver Q1. Input H' is applied to the base of driver Q2. Drivers Q1 and Q2 are connected in a push-pull configuration and apply outputs to the primary of 400-Hz tuned transformer T2. The 400-Hz output is further amplified by RMI amplifiers Q3 and Q4 before being applied to the output bridge circuit. The bridge circuit provides the output to drive the RMI compass card and also applies feedback to rate feedback transformer T1. The feedback is used to damp compass card rotation and prevent overshoot.

(e) 51RV-2B Power Supply Z6. (Refer to figure 14.)

1. +18-Volt DC Output.

The 51RV-2B +18-volt dc output requirement is obtained with a +20.2-volt switching preregulator followed by a +18-volt series regulator.

Capacitors C7, C8, C9, and C11 and resistor R31 form the input filter network that suppresses incoming high-frequency transients and prevents switching transients from being conducted back to the input.

The +20.2-volt switching preregulator consists of Q3, Q8, Q7, Q5, Q6, and Q4. When power is applied, switch Q3 will pass enough current to be sensed by current sensor Q8. This will enable reference amplifier Q7, changing the state of the timing multivibrator (Q5-Q6), and causing Q6 to saturate. Saturation of Q6 will enable switch driver Q4, driving it into saturation, thus causing switch Q3 to saturate. When the current passed by Q3 reaches 3 amperes, current sensor Q8 supplies current to Q7, disabling Q7, which turns off Q6, Q4, and Q3. Switch Q3 remains off for a few microseconds, determined by the current to Q7 and the timing multivibrator (Q5-Q6), and then turns on again, repeating the cycle until the output of the switching preregulator is +20.2 volts. The on and off time of switch Q3 is regulated to maintain the output at +20.2 volts for inputs varying +21 to +30 volts. The current sensor network limits the current output of the switching preregulator to a maximum of 3 amperes. This protects both regulators from short circuits and overloads.

The output of Q10, an emitter follower, is monitored by reference amplifier Q12 which supplies the base current for amplifier Q11; Q11 in turn supplies the base current for driver Q9. The rate of conduction of Q9 regulates the base voltage of Q10 and, thus, its emitter output which is regulated at +18.0 volts.

2. +5-Volt DC Output.

The +5-volt output is provided by a dc-to-ac inverter and rectified by a full-wave rectifier, producing a ripple-free output.

Regulated +18 volts dc is applied through an isolation filter consisting of L1 and C1 to the primary of transformer T1. Transistors Q1 and Q2 and transformer T1 change the +18 volts dc into a 20-kHz square wave. This ac voltage is stepped down by the secondary of T1 and rectified into dc by full-wave rectifiers CR2 and CR3. The +5-volt dc output is filtered by L2 and C5.

(f) VOR/LOC Mode Relay Z1. (Refer to figure 14.)

The VOR/LOC mode relay switches VOR power to the VOR circuit when the 51RV-2B is in VOR mode (VOR frequency selected) and ILS power to the ILS circuit when the 51RV-2B is in ILS mode (localizer frequency selected). The VOR mode enable ANDing circuit consisting of CR2 and CR3 has VOR/ILS mode input and a NAV disable input. When both inputs are at logic 1 (VOR frequency selected), switch Q1 is inhibited and relay K1 is unenergized; VOR power is switched to the VOR circuit in the 51RV-2B. When either the VOR/ILS logic or NAV disable input is at logic 0 (localizer frequency selected or a frequency out of NAV range selected), switch Q1 is saturated and relay K1 is energized; ILS power is switched to the ILS circuit in the 51RV-2B.

(4) 844A-1 VOR/LOC Instrumentation Planar Assembly, Block Diagram Theory.

(a) Primary VOR Instrumentation. (Refer to figure 15.)

The primary VOR instrumentation channel consists of circuits necessary to accomplish VOR operation. A monitor VOR channel which is identical to the primary channel is in parallel with the primary channel. The monitor channel receives the same audio input as the primary channel.

Automatic VOR operation provides the pilot with continuous VOR bearing, relative to magnetic heading, without mechanical manipulation by the pilot.

The reference 30-Hz signal which is FM modulated on the 9960-Hz subcarrier is coupled from the vhf receiver detector output to primary reference 9960-Hz amplifiers Z3Q1, Z3Q2, and Z3Q3. The 9960-Hz output signal from Z3Q3 is applied to primary reference slope detector Z3Q4 through Z3Q6. The slope detector converts the frequency changes of the FM input to amplitude changes, thereby providing a 30-Hz output. The reference signal is amplified in primary reference 30-Hz amplifiers Z1Q1 and Z1Q2. The output of primary reference 30-Hz amplifier Z1Q2 is applied to primary reference buffer amplifier Z1Q161 and to primary reference constant current driver Z1Q162. The output of amplifier Z1Q162 provides current for primary resolver Z1B3. The bearing servo motor B1 positions resolver Z1B3, providing a shift in phase to the reference 30-Hz signal. The output from B3 is amplified to the desired level by primary reference 30-Hz amplifiers Z1Q164 through Z1Q166 before being applied to the primary reference propeller modulation filter, which attenuates harmonics of the 30-Hz reference. The output of the propeller modulation filter is further amplified in primary reference 30-Hz amplifiers Z1Q3 and Z1Q4 and buffer amplifier Z1Q5. The output of Z1Q5 is applied as an input to a primary reference

phase-splitter network consisting of transistors Z1Q6 through Z1Q9. The phase-splitter output is two 30-Hz reference signals 180 degrees out of phase.

The 30-Hz variable signal detected in the receiver is also amplified, filtered, and again amplified before being applied as an input to the phase detector. In the phase detector, the variable 30-Hz is amplified by buffer amplifier Z2Q31 and applied to a differential amplifier circuit consisting of Z2Q32, Z2Q33, Z2Q40, and Z2Q41. This differential amplifier circuit provides two square-wave outputs which are applied to a phase detector driver consisting of Z2Q34 and Z2Q35. The phase detector driver applies inputs to a synchronous chopper consisting of four field-effect transistors Z2Q36 through Z2Q39 and a 60-Hz notch filter. The two reference 30-Hz signals from the phase-splitter are also applied to the synchronous chopper and 60-Hz notch filter. If the reference and variable 30-Hz signals are 90 degrees out of phase, the output of the 60-Hz notch filter is negligible. If they are not 90 degrees out of phase, the 60-Hz notch filter provides a dc level output.

This dc level output is applied to 400-Hz chopper Z2Q77 which is driven by the 26-volt ac, 400-Hz signal coupled through chopper transformer T71. The dc level from the notch filter is thereby converted to 400-Hz ac and is amplified in bearing servo amplifier/driver Z2Q71 through Z2Q76 to drive the bearing servo motor. The motor shaft is mechanically connected to the rotor of resolver Z1B3 and, as the motor turns, the rotor of resolver Z1B3 is turned. The motor will continue to turn until the resolver produces a phase shift sufficient to produce a quadrature relationship between the reference and variable 30-Hz signals. Upon achieving this quadrature relationship, the motor will stop. A rate feedback signal from the generator is applied back to servo amplifier Z2Q71. The feedback is used to damp motor rotation.

The bearing servo motor positions the rotor of a synchro differential with respect to the stators, thereby providing VOR bearing information. The magnetic compass drives the stators of the differential to correspond to the magnetic heading. Voltages are induced in the rotor windings of the synchro differential which are dependent on the angular position of the rotor and on the voltages supplied by the magnetic compass. These rotor voltages drive a synchro receiver called the pointer synchro. The rotor shaft of the pointer synchro is mechanically connected to the RMI pointer. The pointer gives a continuous indication of the angle between the magnetic heading of the aircraft and the VOR bearing. The compass card on the RMI is driven by compass information to give continuous magnetic heading information to the pilot. An RMI servo amplifier (figure 13) is used to increase the compass signal to a level sufficient to drive the RMI compass card.

When the 51RV-2B is tuned to a localizer frequency, the +18-volt dc ILS input to the RMI 3 o'clock bias circuit will cause the RMI pointer to rotate to the 3 o'clock (right wing) position.

(b) Manual VOR Instrumentation, Z1. (Refer to figure 15.)

Manual VOR operation provides the pilot with an indication of deviation from a selected VOR radial. The reference radial of flight is manually selected when the pilot operates the omnibearing selector (OBS) on the course indicator.

The 51RV-2B bearing servo motor rotates 400-Hz resolver B2. A 26-volt ac, 400-Hz signal from the aircraft power system is applied across the rotor of the 400-Hz resolver, inducing a voltage in the stators. This voltage is applied to the stator of a resolver in the external course indicator. The angular position of the rotor of this resolver is selected by the pilot when entering a course on the course indicator. If the course selected in the course indicator corresponds to the VOR bearing set by the motor shaft, the voltage induced in one of the resolver rotors of the course indicator will be 0 volt, and the deviation bar will provide an on-course indication. If the course selected in the course indicator does not correspond with the VOR bearing set by the motor shaft, a voltage will be induced in the rotor of the course indicator, and the deviation bar will provide the appropriate fly left or right indication.

Course resolver rotor A provides an input to the to/from discriminator in the manual VOR instrumentation circuit. The output of this discriminator is applied to the TO-FROM indicator in the external course indicator. The to/from indication from the discriminator is determined by the course of the aircraft, either "to" or "from" the VOR station, and by the pilot selected OBS bearing. The VOR to/from indicator shows whether the direction to the VOR station is within the semicircle centered about the radial selected on the course selector (OBS) or within the semicircle centered about the reciprocal of the selected radial. If the station direction is within 90 degrees of the selected radials, a TO indication appears on the course indicator. If the station direction is within 90 degrees of the reciprocal of the selected radial, a FROM indication appears.

Course resolver rotor B provides an input to the two identical VOR deviation discriminators (one for primary deviation, and the other for secondary deviation). The output of the primary VOR deviation discriminator is applied to the VOR deviation loads in the aircraft, and to one of the inputs of the VOR/LOC comparator. The output of the secondary VOR deviation discriminator provides the second input to the VOR/LOC comparator. Any deviation difference between the primary and secondary deviation discriminator outputs that is greater than a predetermined (and adjustable) amount will be detected by the comparator and will cause a VOR warning flag to show.

When the 51RV-2B is in VOR mode, damping switch Z1Q241 saturates and provides additional damping for both the primary and secondary VOR deviation outputs. When the 51RV-2B is in ILS mode, damping switch Z1Q241 is inhibited, thus providing normal damping requirements for LOC.

Both VOR and LOC use the same VOR/LOC sensor for deviation comparison and signal level sensing. Assume that the 51RV-2B is in the ILS mode (LOC frequency selected). The LOC level voltage from the deviation discriminator

circuits (primary and secondary) is applied to the level sensor and the threshold of the level sensor is set by adjustment of FLAG THRESHOLD control Z2R70. Assume that the 51RV-2B is in the VOR mode. The VOR level voltage from the deviation discriminator circuits (primary and secondary) is greater than the level voltage obtained from the LOC deviation circuits. Therefore, the VOR level voltage must be reduced to coincide with the threshold adjustment made with the 51RV-2B in ILS mode. The reduction of VOR level voltage is accomplished by the saturation of level switch Z1Q242 when the 51RV-2B is in the VOR mode. With Z1Q242 saturated, Z1R255 is inserted across the VOR level voltage and shunts the VOR level down to the level required for proper operation of the level sensor (as adjusted for LOC).

NOTE: For detailed block diagram theory of operation on the manual VOR/LOC sensor refer to paragraph 5. D. (4)(d), localizer instrumentation and manual VOR/LOC sensor.

(c) Monitor VOR Instrumentation. (Refer to figure 15.)

The monitor VOR channel consists of a circuit which is identical to the primary VOR channel. The monitor channel does not drive the bearing servo motor like the primary channel, but the monitor channel does maintain a quadrature phase relationship at its output when the two channels track. These outputs are applied to the VOR null sensor which provides a 2-kHz, square-wave output when the quadrature relationship is maintained within the comparator gate width and the level is at least 70 percent of normal. A warning from the flag circuit results when any phase shift occurs greater than the gate width tolerance.

The reference 30-Hz signal which is frequency modulated (FM) on the 9960-Hz subcarrier is applied from the VOR receiver detector output to monitor reference 9960-Hz amplifiers Z3Q101 - Z3Q103. The 9960-Hz signal output from Z3Q103 is applied to monitor reference slope detectors Z3Q104 through Z3Q106. The slope detector converts the frequency changes of the FM input to amplitude changes, thereby providing a 30-Hz signal output. The reference signal is amplified in monitor reference 30-Hz amplifiers Z1Q81 and Z1Q82 and applied to a propeller modulation filter which attenuates harmonics of the 30-Hz reference signal. The output is then amplified in monitor reference 30-Hz amplifiers Z-Q83 through Z1Q87 and applied as an input to the VOR null sensor.

The 30-Hz variable signal detected in the receiver is amplified by Z1Q121 and Z1Q122. The output of monitor variable 30-Hz amplifier Z1Q122 is applied to buffer amplifier Z1Q181 and monitor variable constant current driver Z1Q182. The output of amplifier Z1Q182 provides current for monitor resolver Z1B5. Bearing servo motor B1 positions resolver Z1B5, providing a shift in phase to the variable 30-Hz signal. The output from B5 is amplified to the desired level by monitor variable 30-Hz amplifiers Z1Q184 through Z1Q186 before being applied to a propeller modulation filter which attenuates harmonics of the 30-Hz variable signal. The output of the

propeller modulation filter is further amplified in monitor variable 30-Hz amplifiers Z1Q123 through Z1Q125 and applied as an input to a monitor variable differential amplifier/phase-splitter network consisting of transistors Z1Q126 through Z1Q129. The phase-splitter output is two 30-Hz variable signals 180 degrees out of phase.

One of the 30-Hz variable signals is phase compared to the reference 30-Hz signal in a phase detector consisting of Z3CR131 and Z3CR132. The other 30-Hz variable signal is phase compared to the reference 30-Hz signal in the phase detector consisting of Z3CR133 and Z3CR134. The two dc level outputs are applied through buffer amplifier Z3Q131 to differential amplifier Z3A101.

The 30-Hz variable signal that is applied to phase detector Z3CR133 and Z3CR134 is also applied to rectifier Z3CR138 and Z3CR139. The resulting dc output is applied to the base of variable level sensor Z3Q136. A 2-kHz reference signal is also applied to the base of variable level sensor Z3Q136. If the dc level applied to the base of Z3Q136 is the correct level, Z3Q136 is enabled, and the 2-kHz reference signal is applied to the base of reference level sensor Z3Q135. The monitor 30-Hz reference signal from monitor reference 30-Hz amplifiers Z3Q83 through Z3Q87 is applied to rectifier Z3CR136 and Z3CR137 which converts the signal to a dc level and applies the dc level to the base of reference level sensor Z3Q135. If this dc level is within the gate width, Z3Q135 is enabled, and the 2-kHz signal is applied to differential amplifier Z3A101. The 2-kHz signal will be amplified and appear at the respective output terminal when the amplifier input is balanced. The 2-kHz signal will not appear when the output amplifier is saturated or inhibited. The amplifier differential gain and the operating point of its output stage are adjusted so that at the desired input difference voltage the output stage ceases to amplify because of cutoff or saturation. At these limit points the ac output signal disappears.

If the VOR circuit is functioning normally, the 2-kHz signal is applied to buffer amplifiers Z3Q133 and ac amplifier Z3Q134. The output of buffer amplifier Z3Q134 is applied to a synchronous filter time delay consisting of resistors Z3R153 and Z3R154 and capacitor Z3C137, with Z3Q137 providing switching. The 2-kHz input to the time delay circuit is synchronously switched by Z3Q137, which has a similar 2-kHz input to its base. Capacitor Z3C137 charges through resistor Z3R153 as each pulse is applied and discharges through resistor Z3R154 when the 2-kHz input to the time delay is removed.

Any failure producing an inbalance in differential amplifier Z3A101 inhibits the 2-kHz output signal, causing the VOR flag to show. The manual VOR/LOC sensor provides a 2-kHz, square-wave output when the primary VOR channel is operating properly. Both this 2-kHz signal and the 2-kHz signal from the monitor channel must be present at the VOR/LOC flag logic and driver to energize the VOR flag and remove it from view. If either channel fails, the failure will cause the VOR flag to show.

(d) Localizer Instrumentation Z1 and Manual VOR/LOC Sensor Z2. (Refer to figure 15.)

From the vhf NAV receiver (tuner and if. circuits), audio output signals are applied to two localizer instrumentation channels, a primary and a secondary channel. In each channel the 90- and 150-Hz signals are amplified and separated by filters. The filter has two tuned secondaries, one resonant at 150 Hz and the other resonant at 90 Hz. Each audio signal is rectified.

Deviation output for the course indicator is taken from the primary channel. Deviation output for comparison with the primary channel deviation output, and for testing purposes, is taken from the secondary channel. If the 150-Hz voltage is greater than the 90-Hz voltage, current flows through the deviation indicator in a direction that causes the deviation bar to deflect to the right. If the 90-Hz voltage is greater than the 150-Hz voltage, current flows through the deviation indicator in a direction that causes the deviation bar to deflect to the left. If the 90- and 150-Hz signals are equal, the resulting zero voltage developed causes zero current to flow, centering the deviation bar.

Level outputs are taken from the primary VOR channel (VOR mode) or localizer channel (ILS mode) and applied to the VOR/LOC level sensor. Each of the two level outputs are filtered and applied to a level modulator/chopper consisting of field-effect transistors (fet) Q18 and Q19. Switching is accomplished in level modulator/chopper Q18 and Q19 by a 2-kHz input to the fet's. The 2-kHz ac signals are applied to the manual VOR/LOC sensor from the dc-to-ac inverter located on the glideslope receiver planar assembly. The 2-kHz outputs from the dc-to-ac inverter are also applied to a full-wave rectifier consisting of diodes CR12 through CR15, thereby producing the +30-volt dc and -30-volt dc power required in the manual VOR/LOC sensor. The resulting 2-kHz difference voltage from the modulator/chopper is amplified by operational amplifier A7 and demodulated to a dc voltage. The dc voltage is applied to differential-amplifier level sensor consisting of Q23 and Q25, whose reference is perturbed at a 50-kHz rate by the output of 50-kHz oscillator Q24. When the demodulated dc level is above the minimum reference level and below the maximum perturb level, a 50-kHz, square-wave output results. Flag level deviations of greater than ±30 percent from normal result in no 50-kHz output. The 50-kHz output signal is attenuated to a low level and applied to the VOR/LOC comparator channel.

The fail-safe comparator circuit receives the deviation outputs primary + right deviation and secondary + right deviation from the manual VOR instrumentation (VOR mode) or from the localizer instrumentation (ILS mode) and RC filters these inputs to remove any remaining ripple. The two dc deviation signals are then added to the 50-kHz signal from the level sensor, in a filter and summing network consisting of R1, R2, C3, and C4. The ac signals with dc deviation levels are applied to a difference modulator/chopper consisting of field-effect transistors Q1 and Q2, with switching accomplished by 2-kHz inputs to the fet's. After modulation in Q1 and Q2

and amplification by operational amplifiers A1-A3, a 2-kHz, square-wave difference signal is produced with amplitude proportional to sec + r dev minus pri + r dev and with a small 50-kHz modulation. This signal is applied to a clipper-limiter circuit consisting of diodes CR1 through CR4 whose threshold is above the 50-kHz signal level when pri + r dev equals sec + r dev. When the difference voltage pri + r dev minus sec + r dev increases above the clipper threshold, the 50-kHz modulation is stripped off and its level is reduced. The clipper threshold modifier changes the clipper threshold as a function of the modifier input.

The 51RV-2B comparator utilizes a separate VOR/LOC threshold modifier channel. The dc deviation levels are summed and superimposed on the output of modulator shunt shopper Q11. This produces a square-wave signal that is amplified in operational amplifiers A5-A6 and detected in Q16 converting the square-wave output to dc. The dc is applied to limiter control Q17, and the output voltage is proportional to the deviation deflection. Limiter control input to the threshold modifier limiter makes the comparison warning gate width increase proportionally with the absolute deviation magnitudes. The limiter is applied through a spike limiter circuit before being amplified by operational amplifier A4 and transformer coupled to 50-kHz detector Z1CR281, Z1CR282. The detector output is applied to differential amplifier level sensor Z1Q281, Z1Q283 whose reference is perturbed at a 2-kHz rate and to amplifier Z1Q282. When the detected dc level is above the minimum reference level and below the maximum perturb level, a 2-kHz, square-wave output results. The level sensor in the manual VOR/LOC sensor is capable of discriminating the 6-db amplitude change that results at the detector when a chopper fails to remain in one state. Component failures in the comparator of the manual VOR/LOC sensor will usually cause loss of the 50-kHz signal entirely or change the 50-kHz amplitude enough to lose the output signal and present a warning condition. Any change from normal will cause the output 2-kHz signal to disappear and place the VOR/LOC CCCS flag, high power flag, and low-level flag outputs at zero. When this condition occurs, the VOR/LOC flag will come into view.

(e) VOR/LOC Flag Logic and Driver, and Power Flag. (Refer to figure 15.)

The VOR/LOC flag logic and driver requires two 2-kHz inputs to energize power flag relay Z1K281 when the 51RV-2B is in VOR mode. The VOR/LOC flag logic and driver requires one 2-kHz input to energize power flag relay Z1K281 when the 51RV-2B is in ILS mode.

When the 51RV-2B is in VOR mode, the 2-kHz output of Z1Q282 is applied to the AND gate circuit containing Z3Q181. The 2-kHz output from the VOR null sensor in the monitor VOR channel must also be present before the AND gate will apply an output to exclusive OR gate Z3Q182. If the vhf synthesizer lock input to the exclusive OR gate is a logic 1 (vhd synthesizer on frequency), Z3Q182 will couple the signal to flag driver Z3Q183. If the flag enable signal is present (no self-test initiated), flag driver Z3Q183 will provide a 2-kHz output. The 2-kHz output from flag driver Z3Q183 is rectified and applied to power flag relay Z1K281. The relay is energized

and CCCS flag, high power flag, and low-level flag outputs are provided to remove the VOR/LOC flags from view.

When the 51RV-2B is in ILS mode, the output from AND gate Z3Q181 is removed due to loss of 2 kHz from the VOR null sensor. However, the 2 kHz from amplifier Z3Q182 is now coupled through inverters Z3Q184 and Z3Q185. Bias voltage for the two inverters is provided by +18 volts dc ILS, not present when the 51RV-2B is in VOR mode. The 2-kHz output from Z3Q185 is not applied to exclusive OR gate Z3Q182 and is processed to energize the power flag relay in the same manner as the input from Z3Q181, applied when the 51RV-2B is in VOR mode.

(5) 951A-1 Glideslope Receiver Planar Assembly, Block Diagram Theory.

(a) UHF Synthesizer. (Refer to figure 16.)

The uhf synthesizer provides 119.8- to 121.7-MHz ac injection to the glideslope receiver. The injection frequency is tripled and applied to the first mixer, where it is used to provide the 30.1-MHz first if.

The 119.8- to 121.7-MHz output from voltage-controlled oscillator Z12Q3 is amplified and applied to mixer Z12Q6 along with the appropriate injection signal of the matching VOR/LOC frequency from the vhf synthesizer (126.1 to 129.9 MHz). The resulting if. signal of 4.5 to 9.5 MHz is filtered and amplified before being applied to a variable counter. Pilot selected information from the tuning wires controls the division ratio of the variable counter between 90 and 190.

When the output of vco Z12Q3 is tuned to the appropriate frequency, the variable counter output is a 50-kHz signal. This signal is applied to a flip-flop phase detector and a frequency detector network. The reference 50-kHz signal is applied to the phase detector and frequency detector. With both the reference input and the variable counter output signal at 50 kHz, the frequency detector applied outputs to Z10Q7 and Z10Q8, which disable Z10Q7 and Z10Q8. With Z10Q7 and Z10Q8 disabled, the pulse stretcher networks and output transistors Q1 and Q2 are disabled. The logic 1 levels appearing on the collector of Z10Q1 and of Z10Q2 are applied to the flip-flop phase detector and to uhf synthesizer lock detector A3A. The logic 0 output from lock detector A3A disables loop response control Z10Q9 and uhf synthesizer lock indicator Z10Q3. The positive voltage output resulting from the disabling of lock indicator Z10Q3 permits transistor Z12Q5 to be enabled, providing that disable inverter Z12Q11 is disabled. When Z12Q5 is enabled, output amplifier Z12Q4 is also enabled. This then provides the 119.8- to 121.7-MHz output from the uhf synthesizer to the glideslope receiver. Transistor Z12Q5 will be enabled when the glideslope NAV disable and test enable inputs to inverter Q11 are at logic 0. Energizing a test or choosing a frequency that is not a VOR/ILS frequency (on the control unit) will put the test enable or glideslope NAV disable input at logic 1. The uhf synthesizer output is then inhibited by the input to output amplifier control Z12Q5 from disable inverter Z12Q11. The logic 1 levels applied from the pulse

stretcher networks to flip-flop phase detector A1 prevent the flip-flop from going into the set or reset condition. The 50-kHz reference input and the 50-kHz signal input to the flip-flop phase detector triggers the flip-flop and provides a 50-kHz output signal, which is coupled through limiter-amplifier Z10Q4 to 50-kHz, low-pass filter FL1. The filter removes the 50-kHz component and provides a dc level dependent on the duty cycle of the input 50-kHz signal. This dc level is applied to the tank circuit controlling the output of vco Z12Q3. Vcp Z12Q3 is thereby locked to the correct frequency.

When the output of vco Z12Q3 is not tuned to the correct frequency, the variable counter output differs in frequency from the 50-kHz reference. The frequency detector output enables Z10Q8 or Z10Q7, depending upon whether the vco is low in frequency or high in frequency respectively. The pulse stretcher network maintains the output of Z10Q2 or Z10Q1 at a logic 0. This logic 0 from either Z10Q2 (vco low in frequency) or Z10Q1 (vco high in frequency) is applied to the R_d (or S_d) terminal of the flip-flop phase detector and to uhf synthesizer lock detector A3A. The lock detector applies a logic 1 to the base of loop response control Z10Q9 and uhf synthesizer lock indicator Z10Q3. The output from lock indicator Z10Q3 permits output amplifier control Q5 to be disabled, thereby inhibiting off-frequency ac injection through output amplifier Q4. The flip-flop phase detector is put in a reset (or set) state by the logic 0 input to the R_d (or S_d) terminal from the pulse stretcher. Limiter-amplifier Z10Q4 is enabled (or disabled) by the phase detector output and thereby provides for a higher (or lower) tuning voltage output to the 50-kHz, low-pass filter. The loop response control network, switched into the tuning voltage output circuit by loop response control Z10Q9, slows the application of this tuning voltage to the 50-kHz filter and subsequent vco Z12Q3 tank circuit. When vco Z12Q3 has tracked to the proper frequency, the reset (or set) condition is removed from the flip-flop phase detector, and the tuning voltage is held constant. The output from lock indicator Z12Q3 returns to normal, and output amplifier Z12Q4 is again enabled. The ac output from the uhf synthesizer (119.8 to 121.7 MHz) is applied to the injection switch in the glideslope receiver

(b) UHF Tuner and IF. Circuits.

1. Glideslope Receivers Without 1-Piece UHF Front End Casting. (Refer to figure 16.)

The glideslope antenna input is applied to a minimum loss bandpass filter passing the frequency band 329.3 through 335.0 MHz. The output of the filter is applied to field-effect transistor first mixer Z7Q1, where it is mixed with the tripled injection frequency (359.4 to 365.1 MHz) of the uhf synthesizer. The uhf synthesizer signal is switched through tripler Z7C11 into mixer Z7Q1.

The difference signal from the mixer is applied to 30.1-MHz crystal filter FL7. The 30.1-MHz output of FL7 is coupled through RC matching network Z6R1, C1 to agc controlled amplifiers Z6Q1 and Z6Q2 to produce a 30.1-MHz if. output. The signal is then mixed a second

time in second mixer Z6Q3 with an input of 29.6 MHz from oscillator Z6Q4. The difference output from this mixer is filtered in 500-kHz filter FL1. Following the filter is a 3-stage RC-coupled, 500-kHz if. amplifier Z5Q1, Z5Q2, and Z5Q3 with agc control feedback to the first two stages. This 3-stage if. amplifier brings the signal to the desired level. The amplifier output is transformer coupled to detector Z5CR1.

The detected rf from Z5CR1 is applied to isolation amplifiers Z5Q4 and Z5Q5. Isolation amplifiers Z5Q4 and Z5Q5 provide the audio signal necessary to operate the glideslope instrumentation and an input to the agc circuit.

The agc reference is provided by division of +18 volts dc by Z5R31 and Z5R32. When the detected level from detector CR1 decreases, the agc differential amplifier (Z5Q6, Z5Q7, Z5Q10, Z5Q11) provides an output through agc output amplifier Z5Q8 to increase the gain of the if. amplifiers. When the detected level from detector Z5CR1 increases, the agc differential amplifier provides an output through agc output amplifier Z5Q8 to decrease the gain of the if. amplifiers.

A glideslope NAV disable input is applied to disable the agc output amplifier whenever the 51RV-2B is tuned to a frequency other than a NAV frequency. The glideslope NAV disable input is applied to the base of if. disable Z1Q1 to saturate and ground the agc reference level. As a result, the agc output is raised to maximum level and the if. stages are disabled.

2. Glideslope Receivers With 1-Piece UHF Front End Casting. (Refer to figure 17.)

The glideslope antenna input is applied to a minimum loss bandpass filter passing the frequency band 329.3 through 335.0 MHz. The output of the filter is applied to field-effect transistor first mixer Z7Q1, where it is mixed with the tripled injection frequency (359.4 to 365.1 MHz) of the uhf synthesizer. The uhf synthesizer signal is applied through tripler Z7Q3 into mixer Z7Q1.

The difference signal from the mixer is applied to 30.1-MHz crystal filter Z7FL7. The 30.1-MHz output of Z7FL7 is coupled through RC matching network Z7R24, C26 to agc-controlled amplifiers Z7Q6 and Z7Q7 to produce a 30.1-MHz if. output. The signal is mixed a second time in second mixer Z7Q8 with an input of 29.6 MHz from oscillator Z7Q9. The difference output from this mixer is filtered in 500-kHz filter Z7FL8. Following the filter is 3-stage, RC-coupled, 500-kHz if. amplifiers Z5Q1, Z5Q2, and Z5Q3 with agc control feedback to the first two stages. This 3-stage if. amplifier brings the signal to the desired level. The amplifier output is transformer coupled to detector Z5CR1.

The detected rf from Z5CR1 is applied to isolation amplifiers Z5Q4 and Z5Q5. Isolation amplifiers Z5Q4 and Z5Q5 provide the audio signal necessary to operate the glideslope instrumentation, and an input to the agc circuit.

The agc reference is provided by division of +18 volts dc by Z5R31 and Z5R32. When the detected level from detector CR1 decreases, the agc differential amplifier (Z5Q6, Z5Q7, Z5Q10, and Z5Q11) provides an output through agc output amplifier Z5Q8 to increase the gain of the if. amplifiers. When the detected level from detector Z5CR1 increases, the agc differential amplifier provides an output through agc output amplifier Z5Q8 to decrease the gain of the if. amplifiers.

A glideslope NAV disable input is applied to disable the agc output amplifier whenever the 51RV-2B is tuned to a frequency other than a NAV frequency. The glideslope NAV disable input is applied to the base of if. disable Z1G1 to saturate and ground the agc reference level. As a result, the agc output is raised to maximum level and the if. stages are disabled.

(c) Glideslope Instrumentation Z4 and ILS Sensor Z13. (Refer to figure 16 or 17.)

From the detector circuit, output signals are applied to two instrumentation channels, a primary and a secondary channel. In each channel the 90- and 150-Hz audio signals are amplified and separated by filters. The filter has two tuned secondaries, one resonant at 150 Hz and the other resonant at 90 Hz. Each audio signal is rectified.

The deviation output indication for course indicators is taken from the primary channel. Deviation output for comparison with the primary channel deviation output and for testing purposes is taken from the secondary channel. If the 150-Hz voltage is greater than the 90-Hz voltage, current flows through the deviation meter movement in a direction that causes the deviation indicator to deflect up. If the 90-Hz voltage is greater than the 150-Hz signal, current flows through the deviation meter movement in a direction that causes the deviation indicator to deflect down. If the 90- and 150-Hz signals are equal, the resulting zero voltage developed causes zero current to flow, centering the deviation indicator.

Level outputs are taken from the primary channel and applied to the level sensor in the ILS sensor. Each level output is filtered and applied to a level modulator/chopper which consists of field-effect transistors (fet) Z13Q18 and Z13Q19. A 2-kHz input is applied to each fet from dc-to-ac inverters Z4Q1 and Z4Q2. The pair of 2-kHz signals from the dc-to-ac inverter are also applied to the full-wave rectifier consisting of diodes Z13CR12 through Z13CR15. This full-wave rectifier provides +30- and -30-volt dc power to the ILS sensor circuit. The input to Z13Q18 is 180 degrees out of phase with respect to the input to

Z13Q19. The resultant output of the fet's is a 2-kHz square wave with amplitude proportional to the difference between the two level inputs. Operational amplifier Z13A7 amplifies the signal and applies an input to demodulator Z13Q22. The output of Z13Q22 is a dc difference voltage. This dc voltage is applied to a differential amplifier level sensor consisting of Z13Q25 and Z13Q23, whose reference is perturbed at a 50-kHz rate by an input applied from 50-kHz oscillator Z13Q24. When the demodulated dc level is above the minimum reference level and below the maximum perturb level, a 50-kHz, square-wave output results. Flag level deviations of greater than ±30 percent from normal result in no 50-kHz output. The 50-kHz output signal is attenuated to a low level and applied to the comparator channel.

The fail-safe comparator circuit receives the deviation outputs primary + down deviation and secondary + down deviation from the glideslope instrumentation. These inputs are filtered to remove any remaining ripple. The two dc deviation signals are then added to the 50-kHz signal, from the level sensor, in a filter and summing network consisting of R1, R2, C3, and C4. The ac signals with dc deviation levels are then applied to a difference modulator/chopper consisting of field-effect transistors Z13Q1 and Z13Q2, with switching accomplished by a 2-kHz input to the fet's. After modulation in Z13Q1 and Z13Q2 and amplification by operational amplifiers Z13A1 through Z13A3, a 2-kHz, square-wave difference signal is produced with amplitude proportional to sec + down dev minus pri + down dev and with a small 50-kHz modulation. This signal is applied to a threshold modifier and clipper-limiter circuit consisting of diodes Z13CR1 through Z13CR4, whose threshold is above the 50-kHz signal level when pri + down dev equals sec + down dev. When the difference voltage sec + down dev minus pri + down dev increases above the clipper threshold, the 50-kHz modulation is stripped off, and its level is reduced. The clipper threshold modifier changes the clipper threshold as a function of the modifier input.

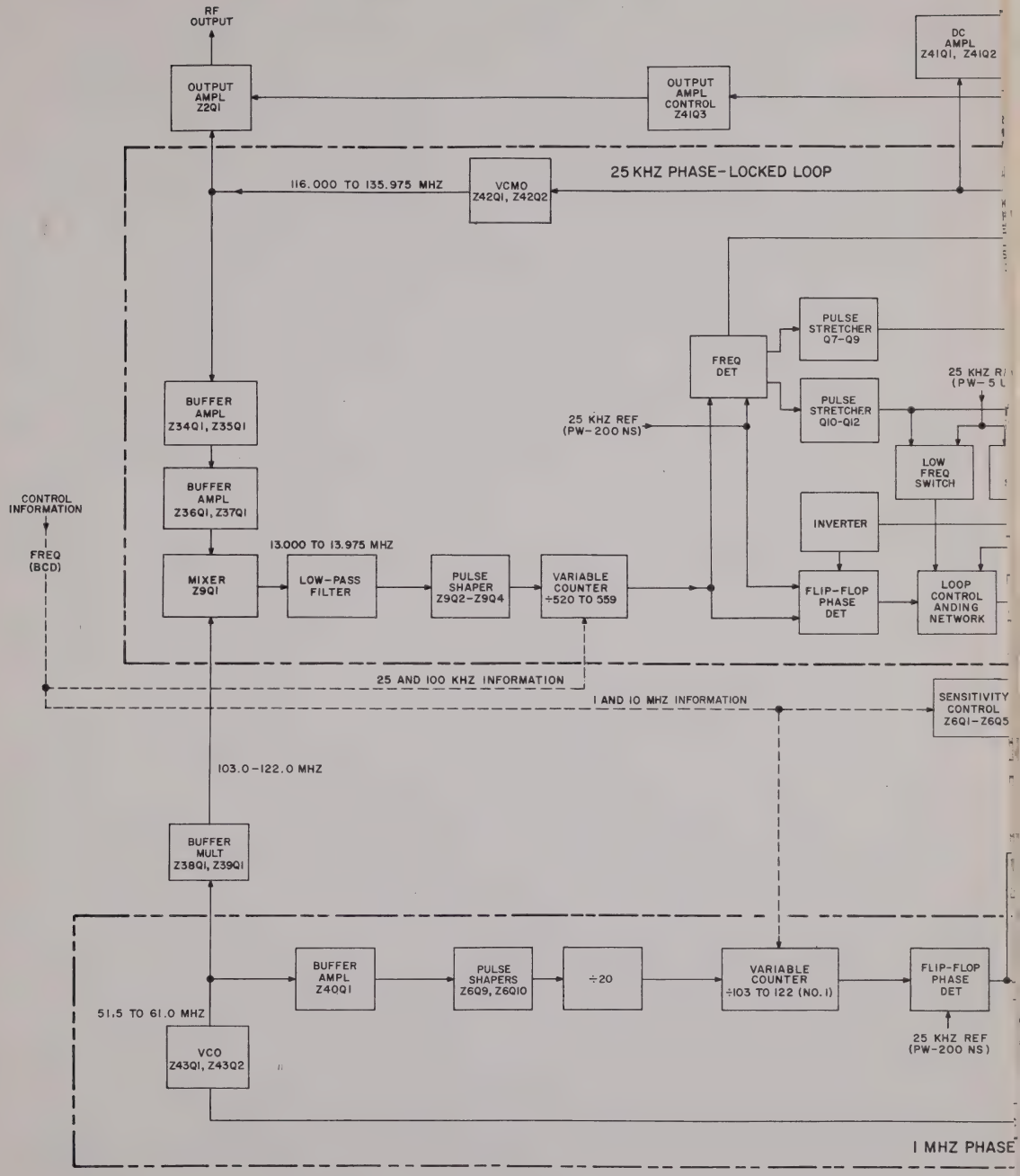
The 51RV-2B comparator utilizes a separate threshold modifier channel. The dc deviation levels are summed and superimposed on the output of modulator shunt chopper Z13Q11. This produces a square-wave signal that is amplified in operational amplifiers Z13A5 and Z13A6, and detected in Z13Q16, converting the square-wave output to dc. The dc is applied to limiter control Z13Q17. The output voltage from limiter control Z13Q17 is proportional to the deviation deflection. This threshold modifier input to the clipper-limiter makes the comparison warning gate width increase proportionally with the absolute deviation magnitudes. The output of the clipper-limiter circuit is amplified in operational amplifier Z13A4 and transformer coupled to 50-kHz detector Z13CR81, Z13CR82. The detector output is applied to differential amplifier level sensor Z13Q81, Z13Q83 whose reference is perturbed at a 2-kHz rate, and to amplifier Z13Q82. When the detected dc level is above the minimum reference level and below the maximum perturb level, a 2-kHz, square-wave output results.

The level sensor in the ILS sensor is capable of discriminating the 6-db amplitude change that results at the detector when a chopper fails to remain in one state. Component failures in the comparator of the ILS sensor will usually cause loss of the 50-kHz signal entirely or change the 50-kHz amplitude enough to lose the output signal and present a warning condition. Any change from normal will cause the 2-kHz ILS sensor output signal to disappear and place the glideslope CCCS flag, high power flag, and low-level flag outputs at zero. When this condition occurs, the glideslope flags will come into view.

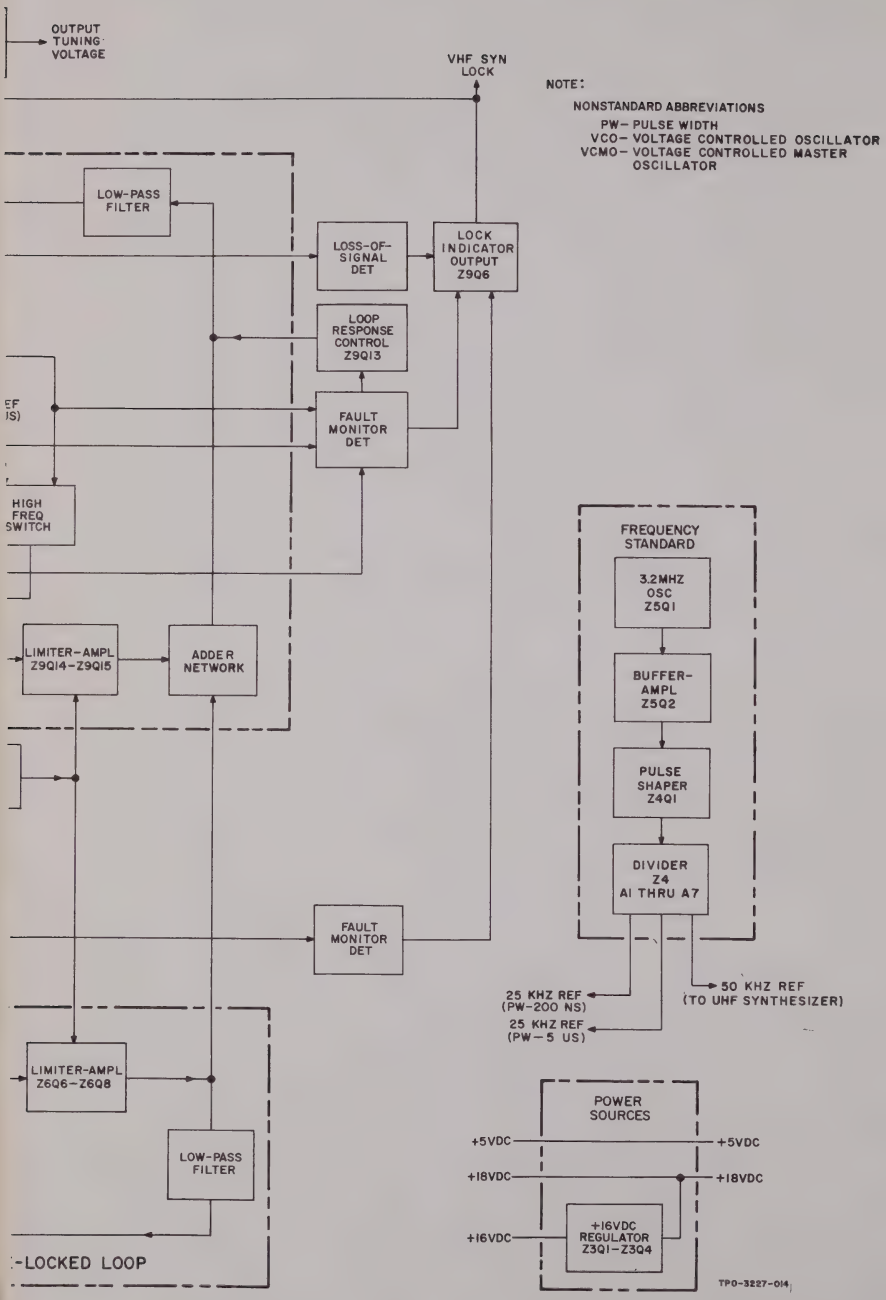
(d) Glideslope Flag Logic and Driver Z2. (Refer to figure 16 or 17.)

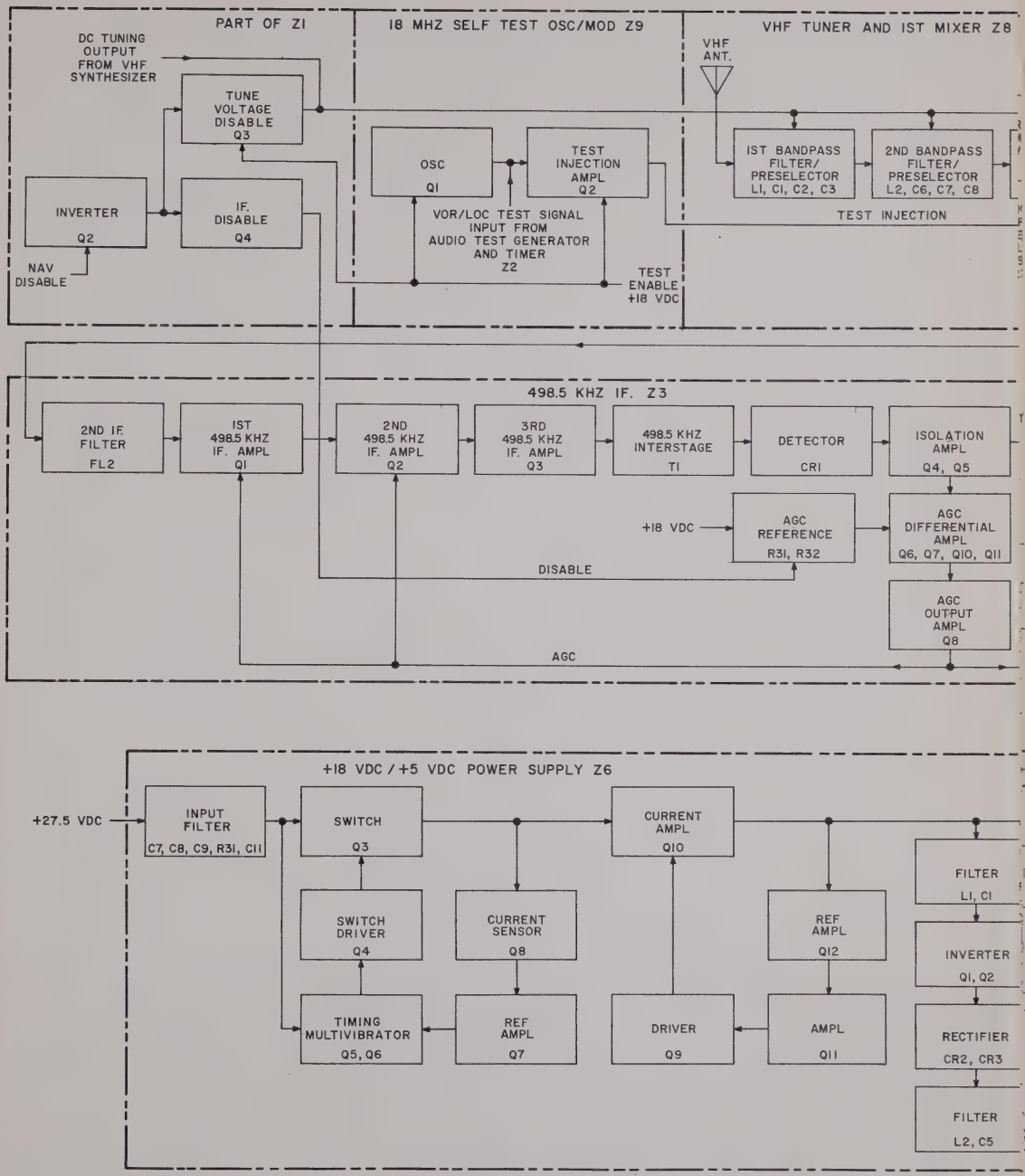
The 2-kHz signal from amplifier Z13Q82 is applied to amplifier Z2Q2. Amplifier Z2Q2 amplifies the 2-kHz signal and applies it to the base of flag driver Z2Q3. The 2-kHz output from Z2Q3 is applied to detectors Z2CR1 and Z2CR3. Detectors Z2CR1 and Z2CR3 convert the 2-kHz signal to a dc level sufficient to operate power flag relay Z2K1. The high power glideslope flag, CCCS flag, and low-level flag outputs are controlled by power flag relay Z2K1.

When the 51RV-2B is in the ILS mode, switch Z2Q1 is inhibited and any glideslope warning flag that occurs is due to a malfunction in the glideslope circuits. However, when the 51RV-2B is in the VOR mode, the glideslope flag remains out of view. This glideslope flag bias during VOR operation is provided by +18 volts dc being applied to the collector of switch Z2Q1, causing Z2Q1 to saturate. The 2-kHz signal present on the base of Z2Q1 is applied through Z2Q1 to Z2Q2. The 2-kHz signal is processed as discussed in the preceding paragraph, causing power flag relay Z2K1 to actuate. This removes the glideslope flag from view when the 51RV-2B is in the VOR mode.

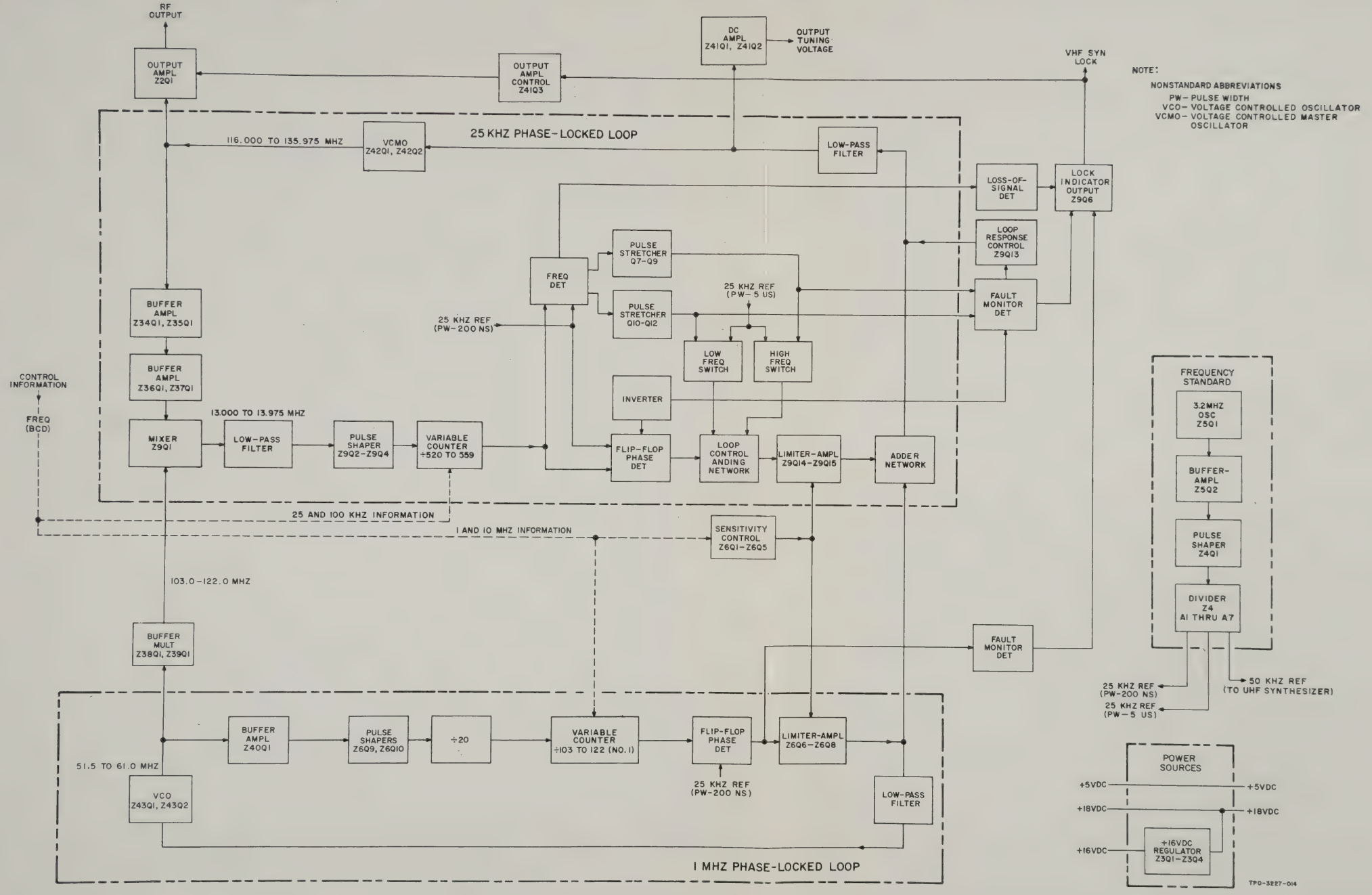


VHF Synthesizer Planar Assembly, Detailed Block Diagram
Figure 13

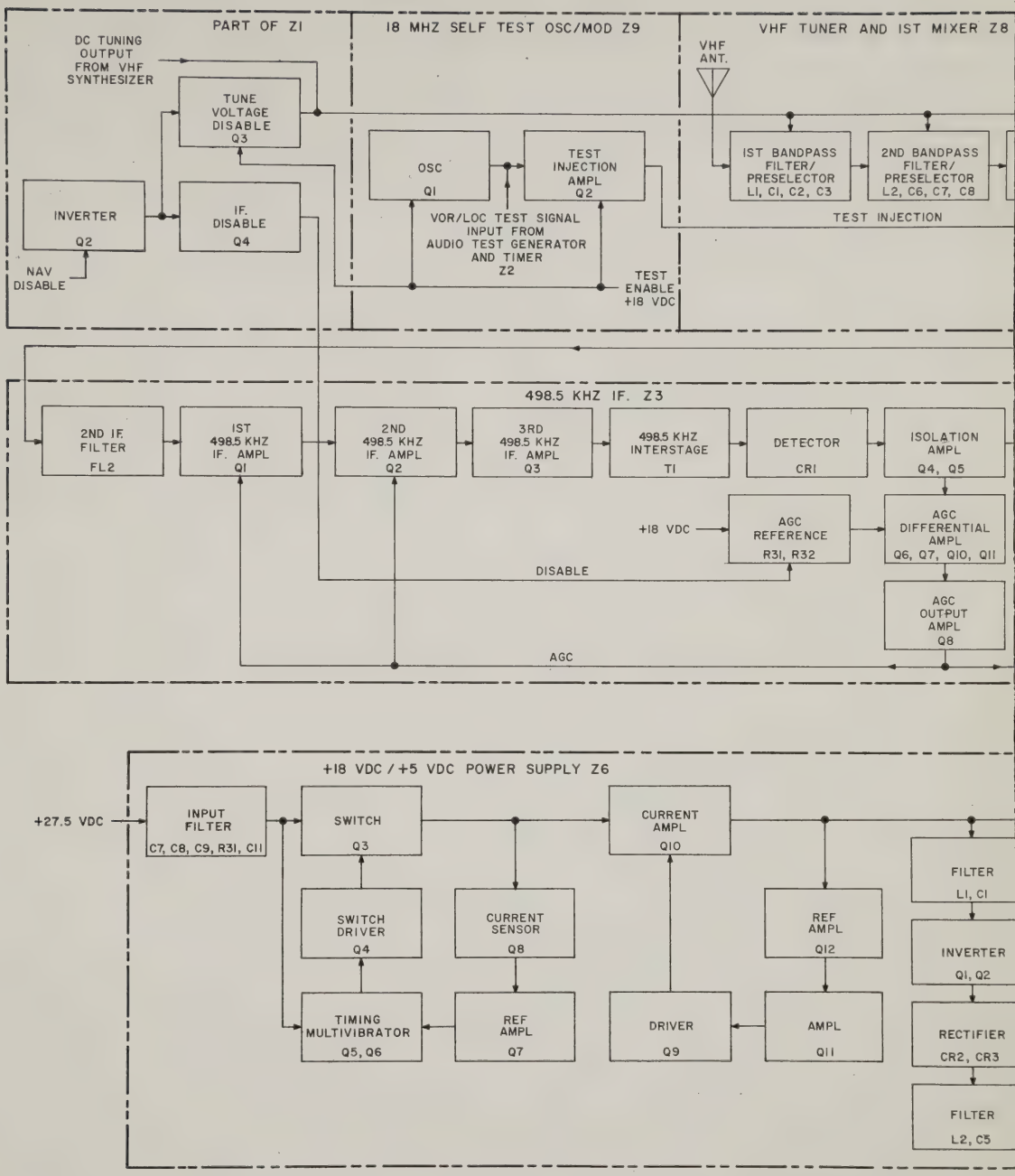

OUTPUT TUNING VOLTAGE
VHF SYN LOCK
NOTE:
NONSTANDARD ABBREVIATIONS
PW- PULSE WIDTH
VCO- VOLTAGE CONTROLLED OSCILLATOR
VCMO- VOLTAGE CONTROLLED MASTER OSCILLATOR
LOW-PASS FILTER
LOSS-OF-SIGNAL DET
LOCK INDICATOR OUTPUT Z9Q6
LOOP RESPONSE CONTROL Z9Q13
FAULT MONITOR DET
HIGH FREQ SWITCH
LIMITER-AMPL Z9Q14-Z9Q15
ADDER NETWORK
FREQUENCY STANDARD
3.2MHZ OSC Z5Q1
BUFFER-AMPL Z5Q2
PULSE SHAPER Z4Q1
DIVIDER Z4 A1 THRU A7
FAULT MONITOR DET
25 KHZ REF (PW-200 NS)
25 KHZ REF (PW-5 US)
50 KHZ REF (TO UHF SYNTHESIZER)
LIMITER-AMPL Z6Q6-Z6Q8
LOW-PASS FILTER
-LOCKED LOOP
POWER SOURCES
+5VDC
+5VDC
+18VDC
+18VDC
+16VDC
+16VDC REGULATOR Z3Q1-Z3Q4
TP0-3227-014


PART OF Z1
18 MHZ SELF TEST OSC/MOD Z9
VHF TUNER AND 1ST MIXER Z8
DC TUNING OUTPUT FROM VHF SYNTHESIZER
TUNE VOLTAGE DISABLE Q3
INVERTER Q2
IF. DISABLE Q4
NAV DISABLE
OSC Q1
TEST INJECTION AMPL Q2
VOR/LOC TEST SIGNAL INPUT FROM AUDIO TEST GENERATOR AND TIMER Z2
TEST ENABLE +18 VDC
VHF ANT.
1ST BANDPASS FILTER/ PRESELECTOR L1, C1, C2, C3
2ND BANDPASS FILTER/ PRESELECTOR L2, C6, C7, C8
TEST INJECTION
498.5 KHZ IF. Z3
2ND IF. FILTER FL2
1ST 498.5 KHZ IF. AMPL Q1
2ND 498.5 KHZ IF. AMPL Q2
3RD 498.5 KHZ IF. AMPL Q3
498.5 KHZ INTERSTAGE T1
DETECTOR CR1
ISOLATION AMPL Q4, Q5
+18 VDC
AGC REFERENCE R31, R32
AGC DIFFERENTIAL AMPL Q6, Q7, Q10, Q11
DISABLE
AGC OUTPUT AMPL Q8
AGC
+18 VDC / +5 VDC POWER SUPPLY Z6
+27.5 VDC
INPUT FILTER C7, C8, C9, R31, C11
SWITCH Q3
CURRENT AMPL Q10
FILTER L1, C1
SWITCH DRIVER Q4
CURRENT SENSOR Q8
REF AMPL Q12
INVERTER Q1, Q2
TIMING MULTIVIBRATOR Q5, Q6
REF AMPL Q7
DRIVER Q9
AMPL Q11
RECTIFIER CR2, CR3
FILTER L2, C5

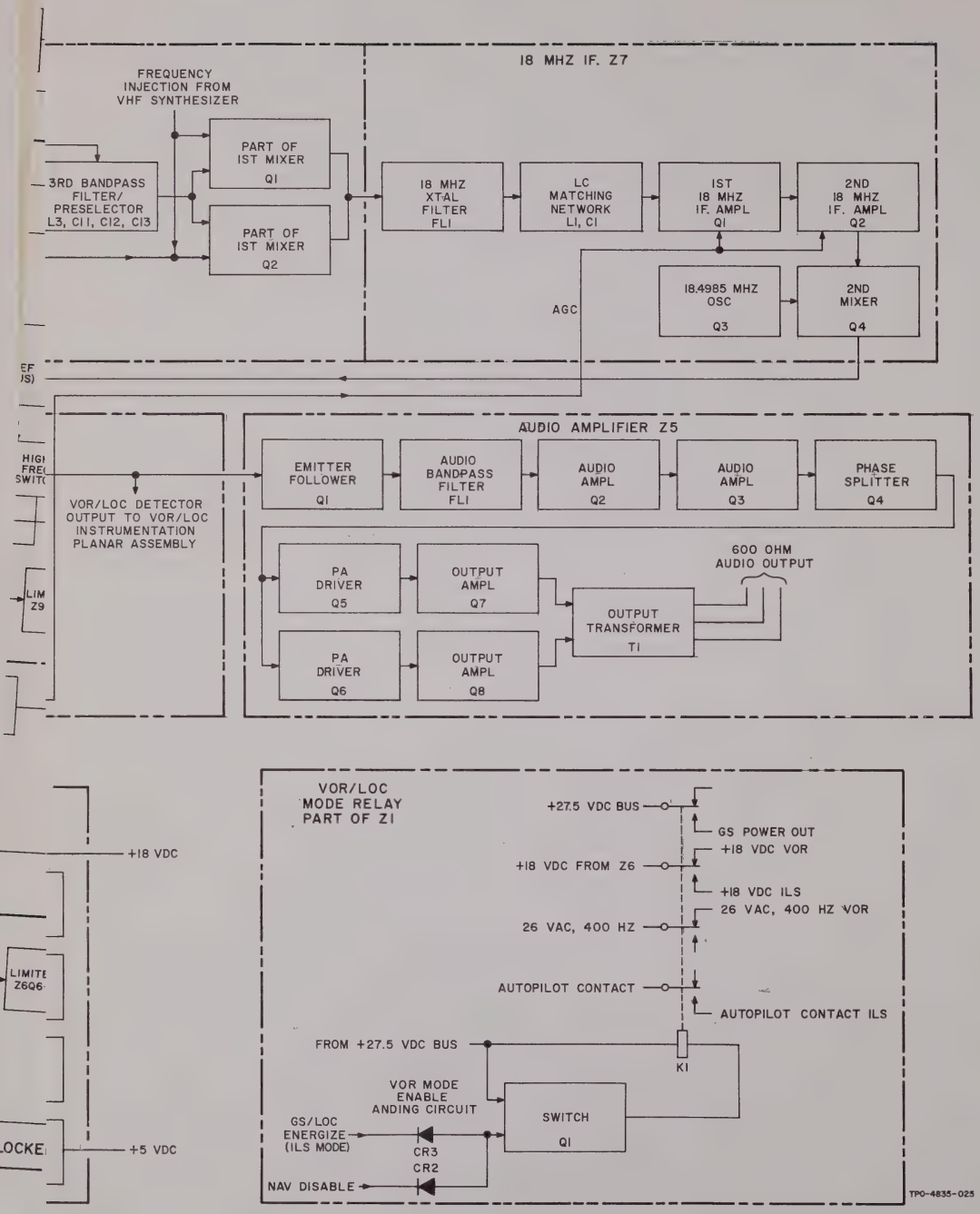
VHF NAV Receiver Planar Assembly, Detailed Block Diagram (Sheet 1 of 2)
Figure 14

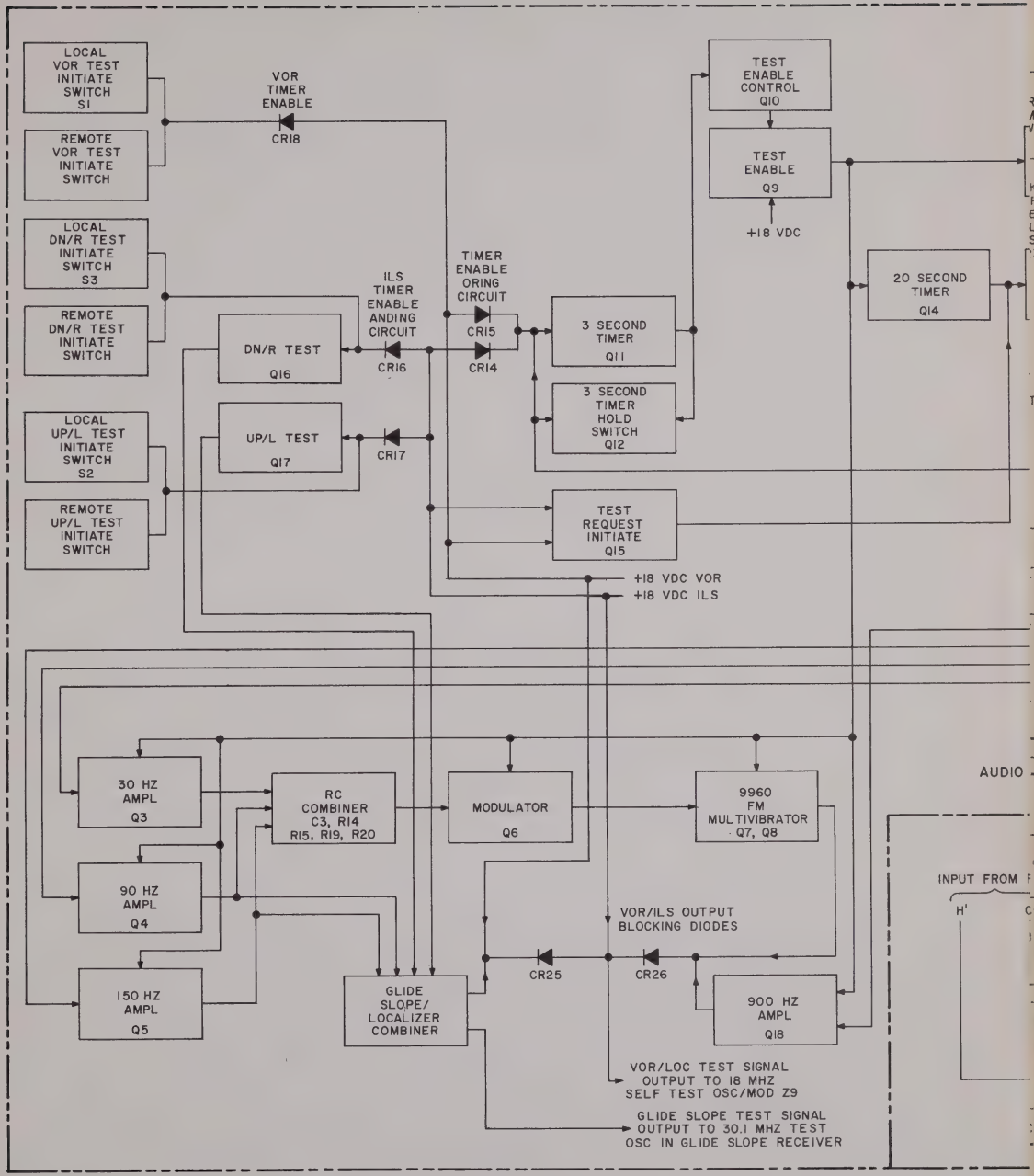


VHF Synthesizer Planar Assembly, Detailed Block Diagram
Figure 13

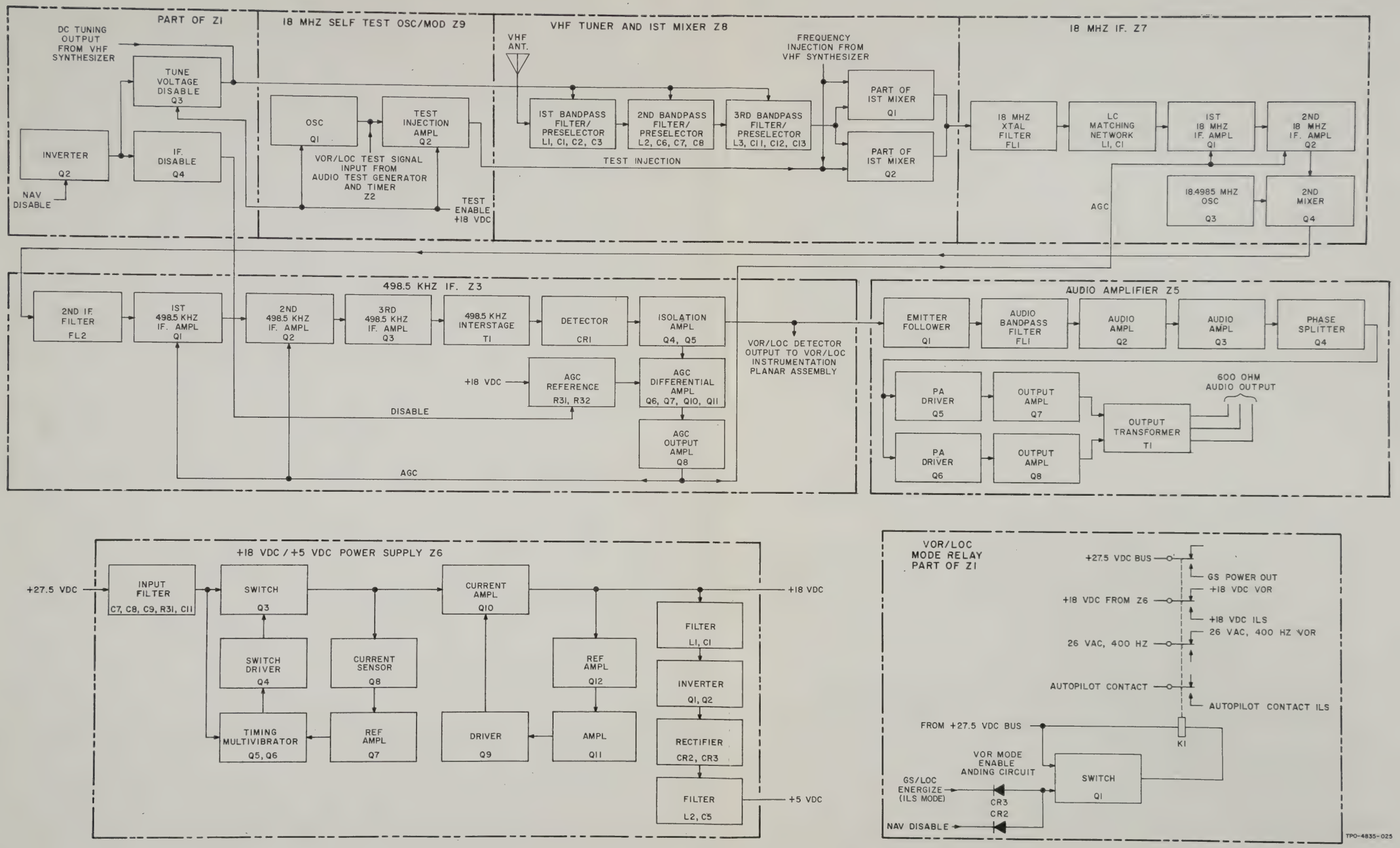

PART OF Z1
18 MHZ SELF TEST OSC/MOD Z9
VHF TUNER AND 1ST MIXER Z8
DC TUNING OUTPUT FROM VHF SYNTHESIZER
TUNE VOLTAGE DISABLE Q3
INVERTER Q2
IF. DISABLE Q4
NAV DISABLE
OSC Q1
TEST INJECTION AMPL Q2
VOR/LOC TEST SIGNAL INPUT FROM AUDIO TEST GENERATOR AND TIMER Z2
TEST ENABLE +18 VDC
VHF ANT.
1ST BANDPASS FILTER/ PRESELECTOR L1, C1, C2, C3
2ND BANDPASS FILTER/ PRESELECTOR L2, C6, C7, C8
TEST INJECTION
498.5 KHZ IF. Z3
2ND IF. FILTER FL2
1ST 498.5 KHZ IF. AMPL Q1
2ND 498.5 KHZ IF. AMPL Q2
3RD 498.5 KHZ IF. AMPL Q3
498.5 KHZ INTERSTAGE T1
DETECTOR CR1
ISOLATION AMPL Q4, Q5
+18 VDC
AGC REFERENCE R31, R32
AGC DIFFERENTIAL AMPL Q6, Q7, Q10, Q11
DISABLE
AGC OUTPUT AMPL Q8
AGC
+18 VDC / +5 VDC POWER SUPPLY Z6
+27.5 VDC
INPUT FILTER C7, C8, C9, R31, C11
SWITCH Q3
CURRENT AMPL Q10
FILTER L1, C1
SWITCH DRIVER Q4
CURRENT SENSOR Q8
REF AMPL Q12
INVERTER Q1, Q2
TIMING MULTIVIBRATOR Q5, Q6
REF AMPL Q7
DRIVER Q9
AMPL Q11
RECTIFIER CR2, CR3
FILTER L2, C5

VHF NAV Receiver Planar Assembly, Detailed Block Diagram (Sheet 1 of 2)
Figure 14

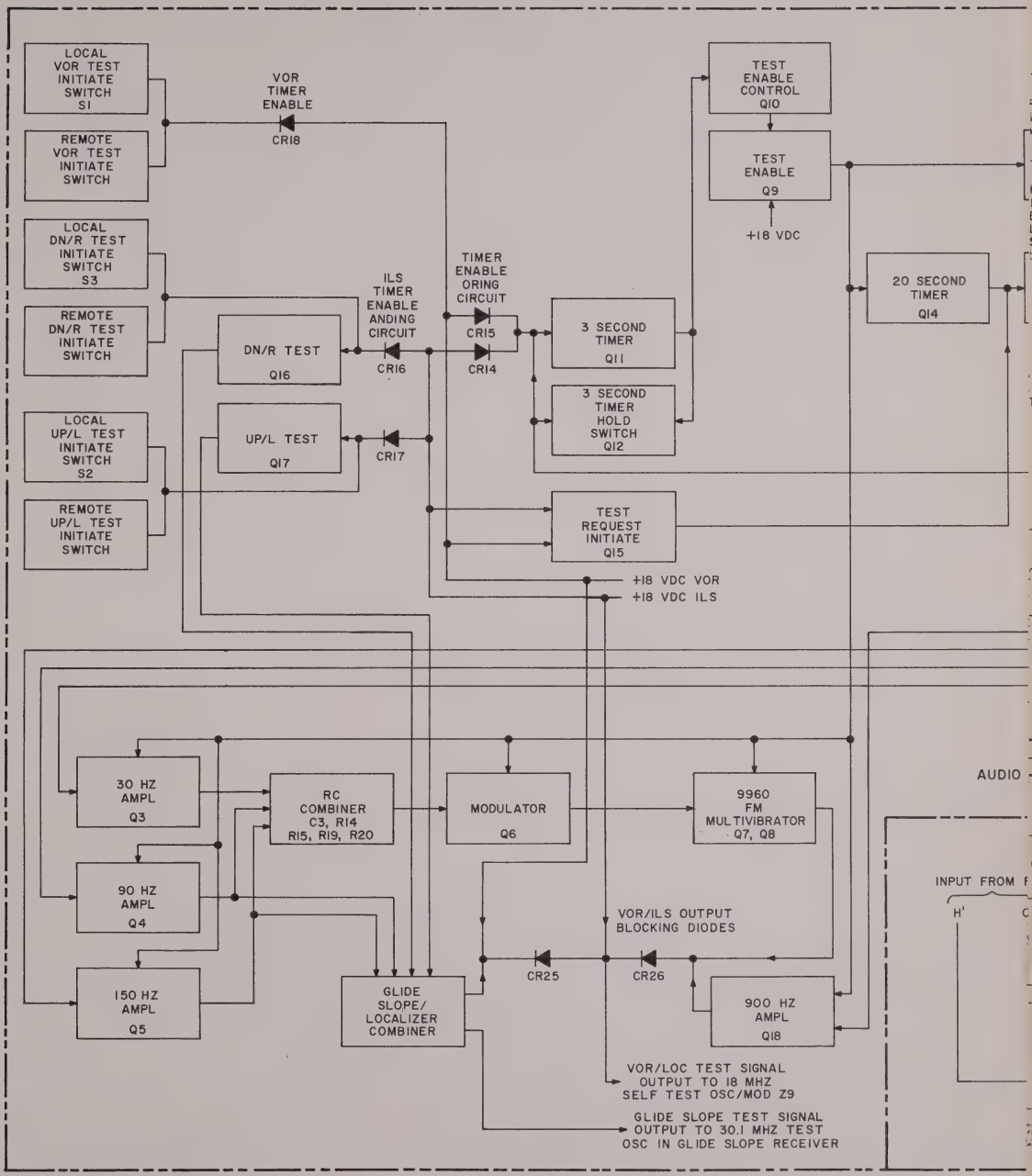

18 MHZ IF. Z7
FREQUENCY INJECTION FROM VHF SYNTHESIZER
3RD BANDPASS FILTER/ PRESELECTOR L3, C11, C12, C13
PART OF IST MIXER Q1
PART OF IST MIXER Q2
18 MHZ XTAL FILTER FL1
LC MATCHING NETWORK L1, C1
IST 18 MHZ IF. AMPL Q1
2ND 18 MHZ IF. AMPL Q2
18.4985 MHZ OSC Q3
2ND MIXER Q4
AGC
AUDIO AMPLIFIER Z5
EMITTER FOLLOWER Q1
AUDIO BANDPASS FILTER FL1
AUDIO AMPL Q2
AUDIO AMPL Q3
PHASE SPLITTER Q4
VOR/LOC DETECTOR OUTPUT TO VOR/LOC INSTRUMENTATION PLANAR ASSEMBLY
PA DRIVER Q5
PA DRIVER Q6
OUTPUT AMPL Q7
OUTPUT AMPL Q8
OUTPUT TRANSFORMER T1
600 OHM AUDIO OUTPUT
+18 VDC
LIMITE Z6Q6
+5 VDC
VOR/LOC MODE RELAY PART OF Z1
+27.5 VDC BUS
GS POWER OUT
+18 VDC VOR
+18 VDC FROM Z6
+18 VDC ILS
26 VAC, 400 HZ VOR
26 VAC, 400 HZ
AUTOPILOT CONTACT
AUTOPILOT CONTACT ILS
FROM +27.5 VDC BUS
K1
VOR MODE ENABLE ANDING CIRCUIT
GS/LOC ENERGIZE (ILS MODE)
SWITCH Q1
CR3
CR2
NAV DISABLE
TPO-4835-025



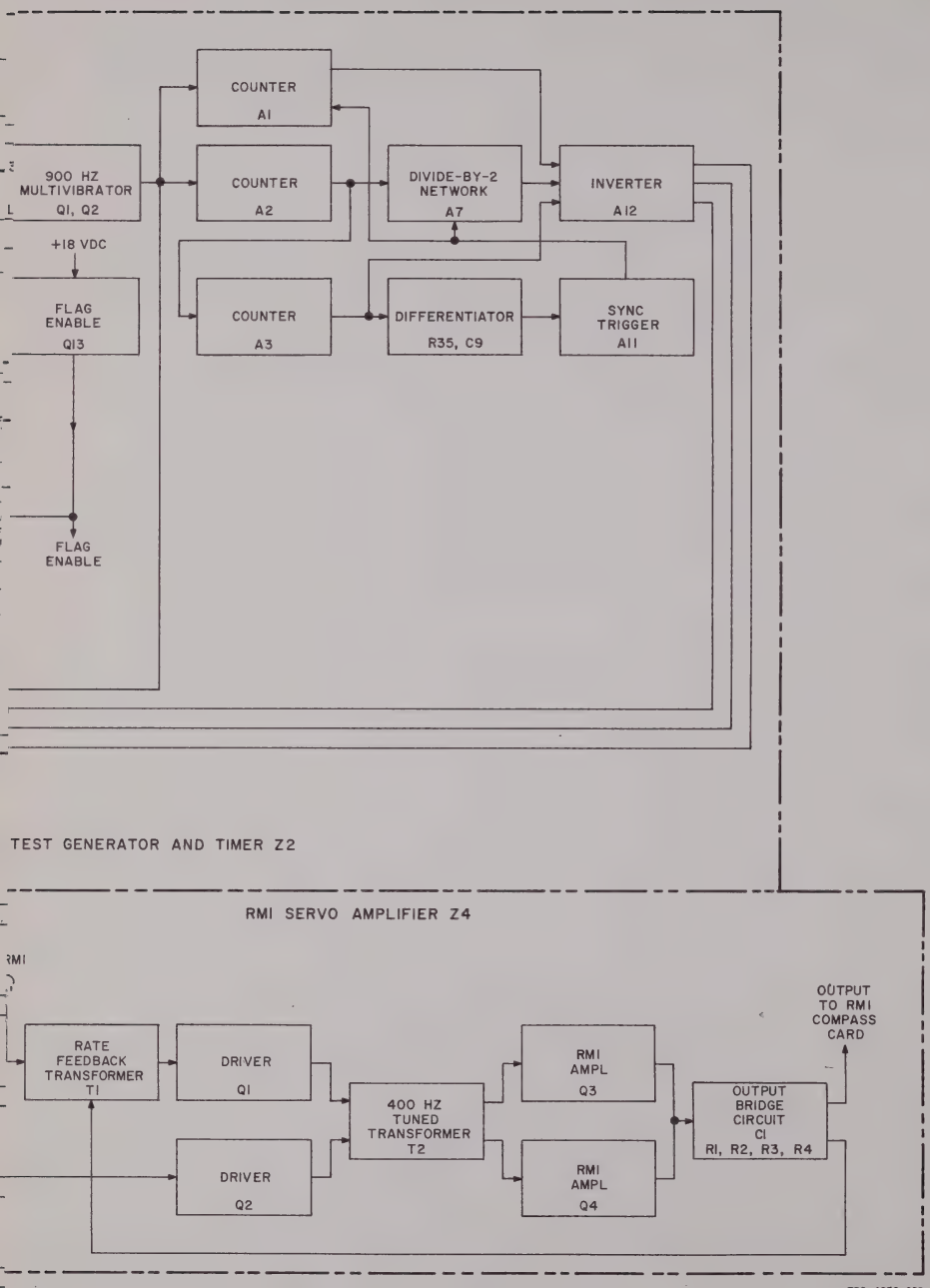
VHF NAV Receiver Planar Assembly, Detailed Block Diagram (Sheet 2 of 2)
Figure 14



VHF NAV Receiver Planar Assembly, Detailed Block Diagram (Sheet 1 of 2)
Figure 14



VHF NAV Receiver Planar Assembly, Detailed Block Diagram (Sheet 2 of 2)
Figure 14



TEST GENERATOR AND TIMER Z2

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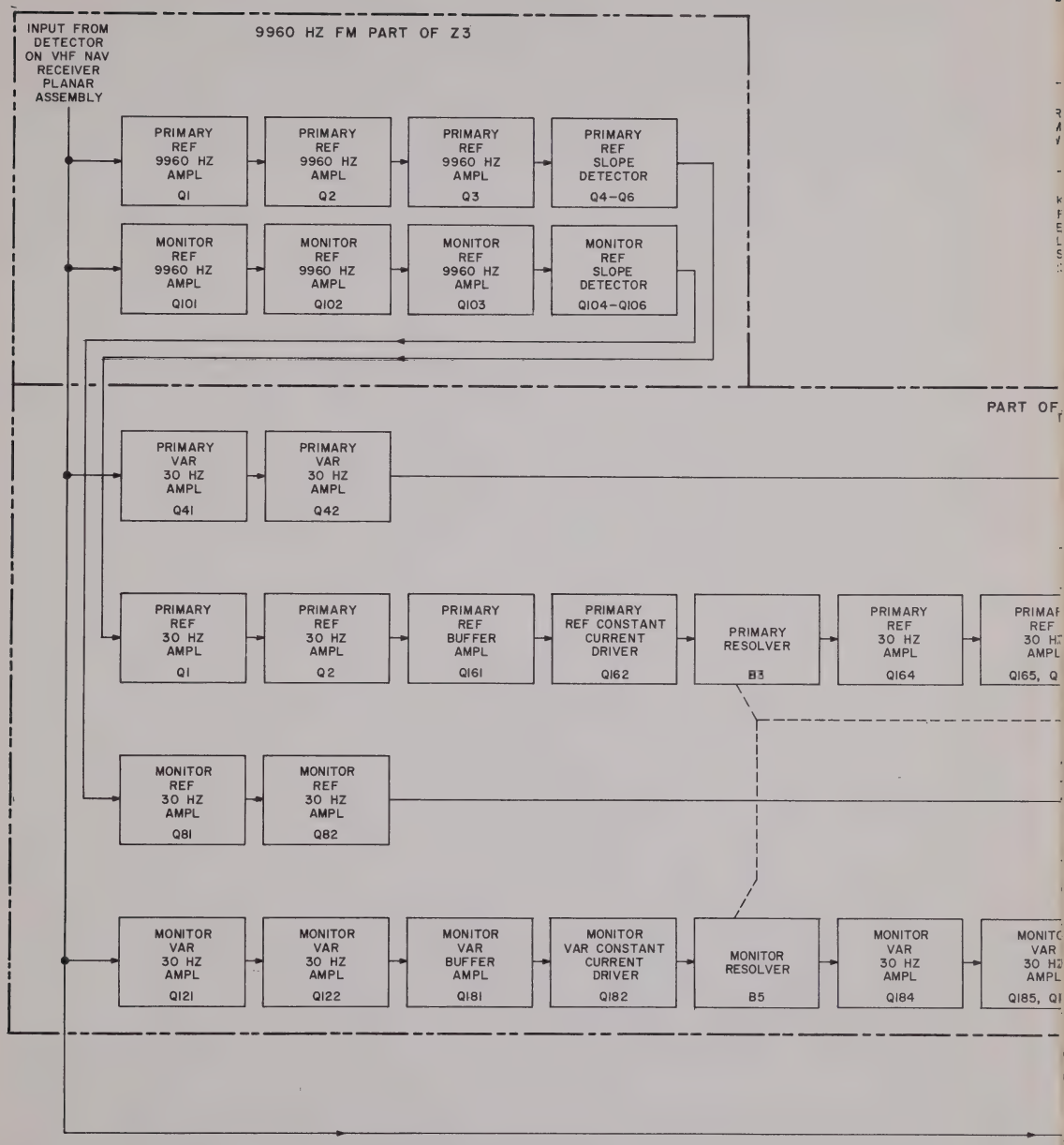
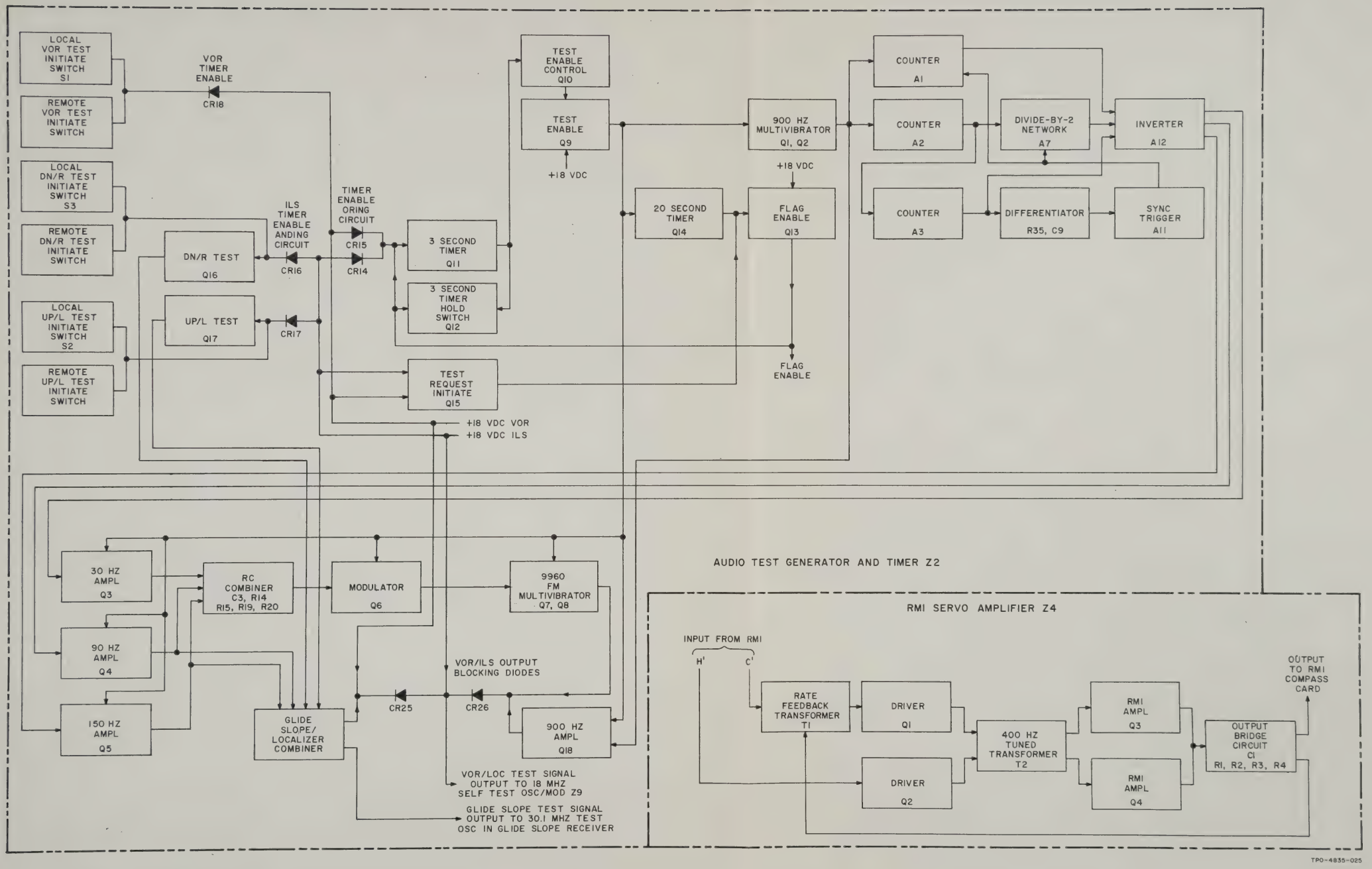
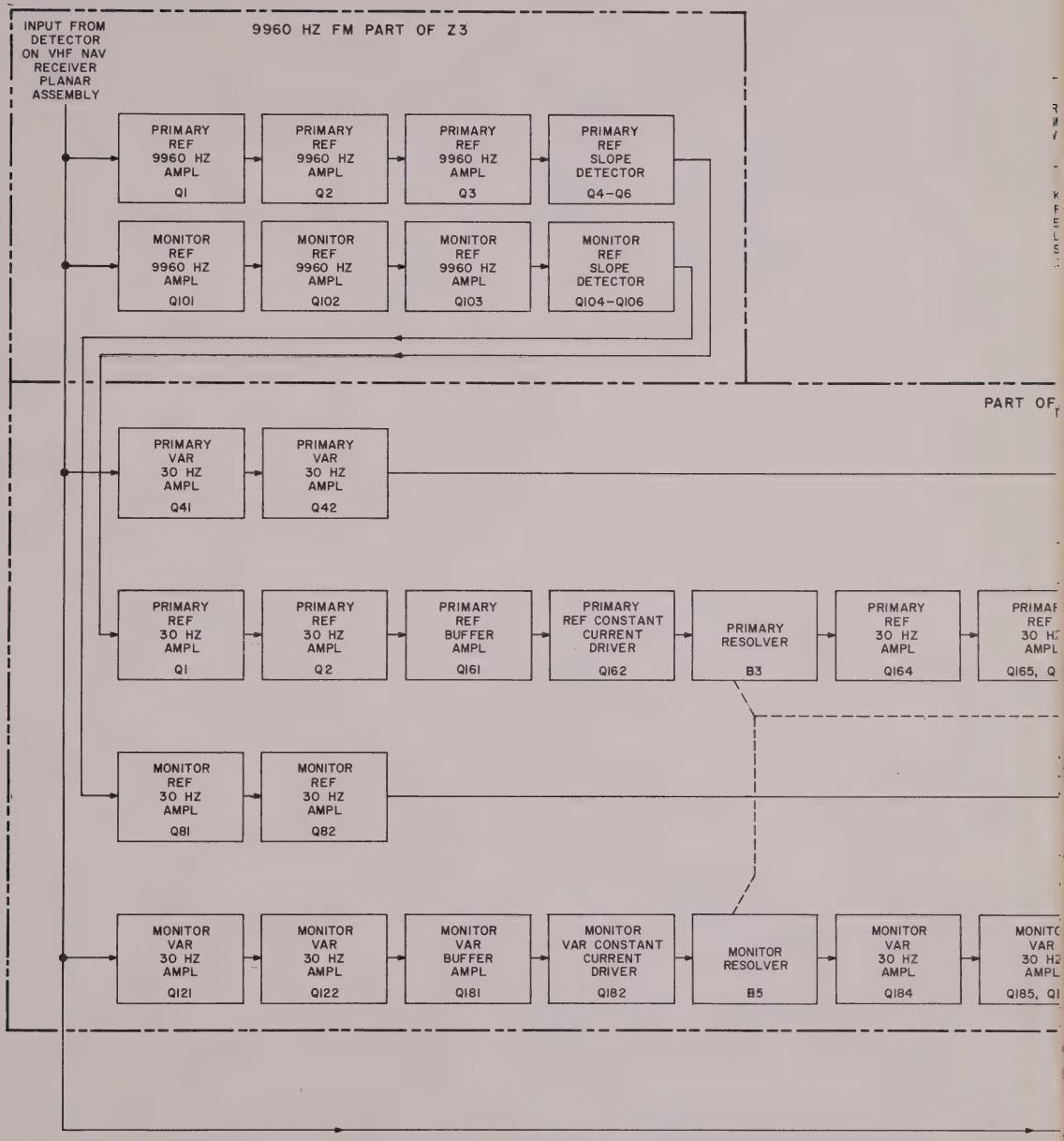

INPUT FROM DETECTOR ON VHF NAV RECEIVER PLANAR ASSEMBLY
9960 HZ FM PART OF Z3
PRIMARY REF 9960 HZ AMPL Q1
PRIMARY REF 9960 HZ AMPL Q2
PRIMARY REF 9960 HZ AMPL Q3
PRIMARY REF SLOPE DETECTOR Q4-Q6
MONITOR REF 9960 HZ AMPL Q101
MONITOR REF 9960 HZ AMPL Q102
MONITOR REF 9960 HZ AMPL Q103
MONITOR REF SLOPE DETECTOR Q104-Q106
PART OF
PRIMARY VAR 30 HZ AMPL Q41
PRIMARY VAR 30 HZ AMPL Q42
PRIMARY REF 30 HZ AMPL Q1
PRIMARY REF 30 HZ AMPL Q2
PRIMARY REF BUFFER AMPL Q161
PRIMARY REF CONSTANT CURRENT DRIVER Q162
PRIMARY RESOLVER B3
PRIMARY REF 30 HZ AMPL Q164
PRIMAF REF 30 HZ AMPL Q165, Q
MONITOR REF 30 HZ AMPL Q81
MONITOR REF 30 HZ AMPL Q82
MONITOR VAR 30 HZ AMPL Q121
MONITOR VAR 30 HZ AMPL Q122
MONITOR VAR BUFFER AMPL Q181
MONITOR VAR CONSTANT CURRENT DRIVER Q182
MONITOR RESOLVER B5
MONITOR VAR 30 HZ AMPL Q184
MONITC VAR 30 HZ AMPL Q185, Q1

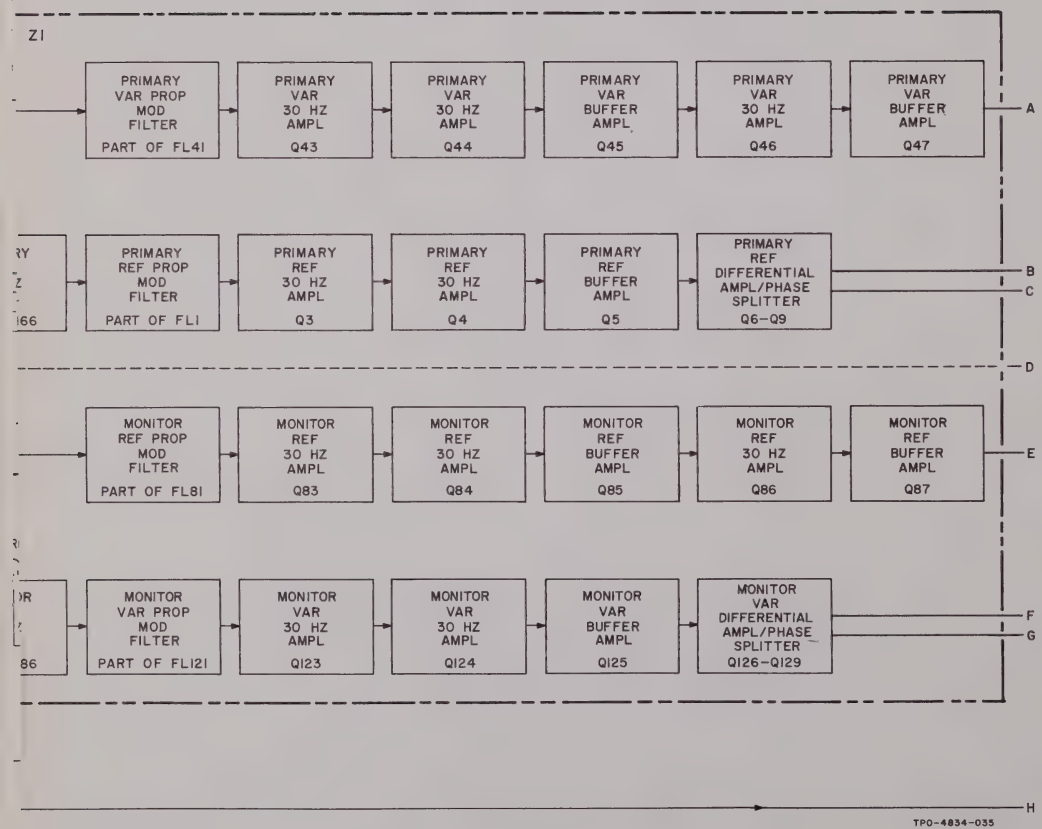
VOR/LOC Instrumentation Planar Assembly, Detailed Block Diagram (Sheet 1 of 3)
Figure 15

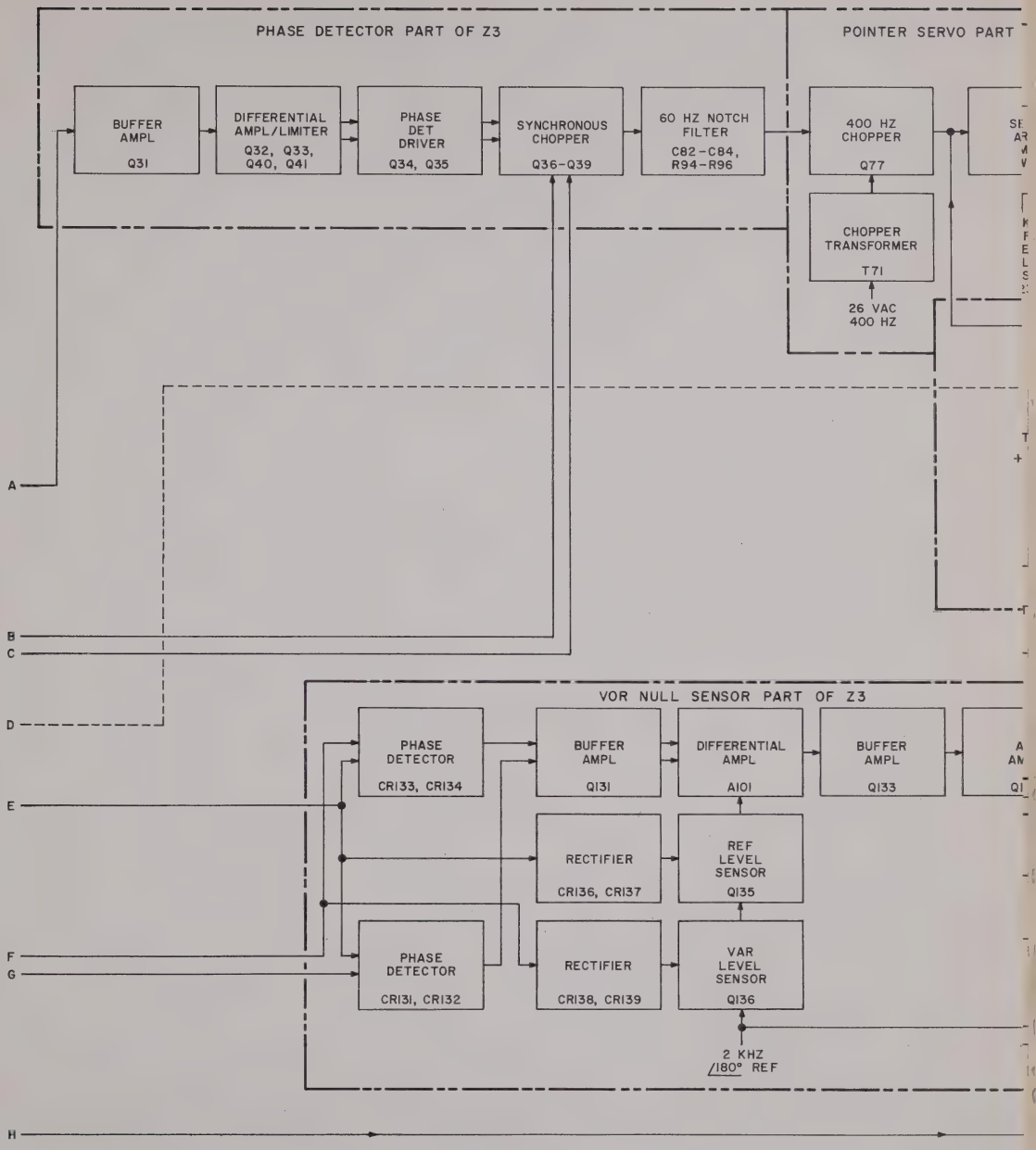

LOCAL VOR TEST INITIATE SWITCH S1
REMOTE VOR TEST INITIATE SWITCH
LOCAL DN/R TEST INITIATE SWITCH S3
REMOTE DN/R TEST INITIATE SWITCH
LOCAL UP/L TEST INITIATE SWITCH S2
REMOTE UP/L TEST INITIATE SWITCH
VOR TIMER ENABLE CR18
ILS TIMER ENABLE ANDING CIRCUIT CR16
TIMER ENABLE ORING CIRCUIT CR15 CR14
DN/R TEST Q16
UP/L TEST Q17 CR17
3 SECOND TIMER Q11
3 SECOND TIMER HOLD SWITCH Q12
TEST REQUEST INITIATE Q15
TEST ENABLE CONTROL Q10
TEST ENABLE Q9
+18 VDC
20 SECOND TIMER Q14
900 HZ MULTIVIBRATOR Q1, Q2
FLAG ENABLE Q13
FLAG ENABLE
+18 VDC VOR
+18 VDC ILS
COUNTER A1
COUNTER A2
COUNTER A3
DIVIDE-BY-2 NETWORK A7
DIFFERENTIATOR R35, C9
INVERTER A12
SYNC TRIGGER A11
30 HZ AMPL Q3
90 HZ AMPL Q4
150 HZ AMPL Q5
RC COMBINER C3, R14 R15, R19, R20
MODULATOR Q6
9960 FM MULTIVIBRATOR Q7, Q8
GLIDE SLOPE/ LOCALIZER COMBINER
VOR/ILS OUTPUT BLOCKING DIODES
CR25
CR26
900 HZ AMPL Q18
VOR/LOC TEST SIGNAL OUTPUT TO 18 MHZ SELF TEST OSC/MOD Z9
GLIDE SLOPE TEST SIGNAL OUTPUT TO 30.1 MHZ TEST OSC IN GLIDE SLOPE RECEIVER
AUDIO TEST GENERATOR AND TIMER Z2
RMI SERVO AMPLIFIER Z4
INPUT FROM RMI
H'
C'
RATE FEEDBACK TRANSFORMER T1
DRIVER Q1
DRIVER Q2
400 HZ TUNED TRANSFORMER T2
RMI AMPL Q3
RMI AMPL Q4
OUTPUT BRIDGE CIRCUIT C1 R1, R2, R3, R4
OUTPUT TO RMI COMPASS CARD
TPO-4835-025

VHF NAV Receiver Planar Assembly, Detailed Block Diagram (Sheet 2 of 2)
Figure 14

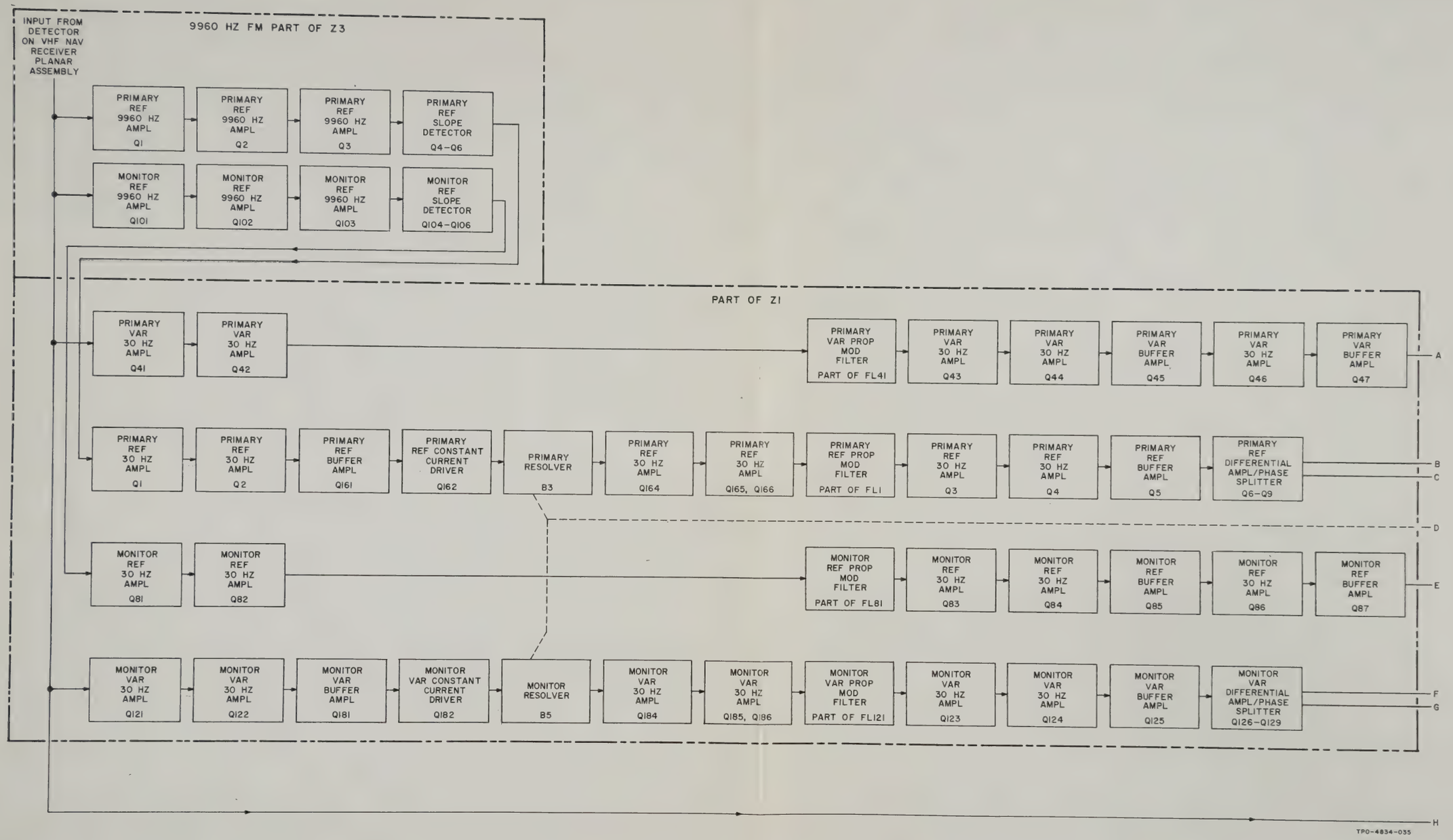

INPUT FROM DETECTOR ON VHF NAV RECEIVER PLANAR ASSEMBLY
9960 HZ FM PART OF Z3
PRIMARY REF 9960 HZ AMPL Q1
PRIMARY REF 9960 HZ AMPL Q2
PRIMARY REF 9960 HZ AMPL Q3
PRIMARY REF SLOPE DETECTOR Q4-Q6
MONITOR REF 9960 HZ AMPL Q101
MONITOR REF 9960 HZ AMPL Q102
MONITOR REF 9960 HZ AMPL Q103
MONITOR REF SLOPE DETECTOR Q104-Q106
PART OF
PRIMARY VAR 30 HZ AMPL Q41
PRIMARY VAR 30 HZ AMPL Q42
PRIMARY REF 30 HZ AMPL Q1
PRIMARY REF 30 HZ AMPL Q2
PRIMARY REF BUFFER AMPL Q161
PRIMARY REF CONSTANT CURRENT DRIVER Q162
PRIMARY RESOLVER B3
PRIMARY REF 30 HZ AMPL Q164
PRIMAF REF 30 HZ AMPL Q165, Q
MONITOR REF 30 HZ AMPL Q81
MONITOR REF 30 HZ AMPL Q82
MONITOR VAR 30 HZ AMPL Q121
MONITOR VAR 30 HZ AMPL Q122
MONITOR VAR BUFFER AMPL Q181
MONITOR VAR CONSTANT CURRENT DRIVER Q182
MONITOR RESOLVER B5
MONITOR VAR 30 HZ AMPL Q184
MONITC VAR 30 HZ AMPL Q185, Q1

VOR/LOC Instrumentation Planar Assembly, Detailed Block Diagram (Sheet 1 of 3)
Figure 15

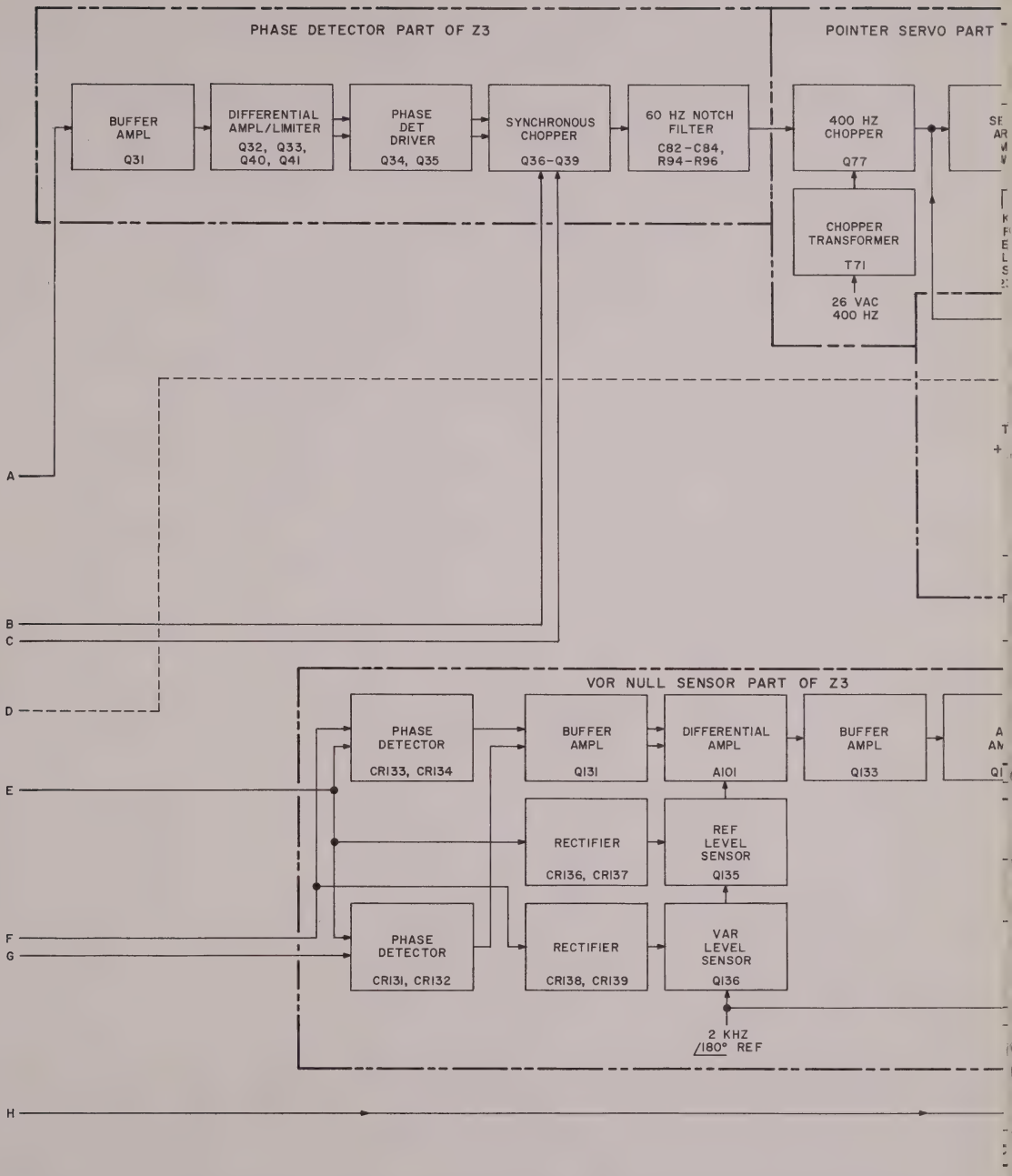

Z1
PRIMARY VAR PROP MOD FILTER
PART OF FL41
PRIMARY VAR 30 HZ AMPL
Q43
PRIMARY VAR 30 HZ AMPL
Q44
PRIMARY VAR BUFFER AMPL
Q45
PRIMARY VAR 30 HZ AMPL
Q46
PRIMARY VAR BUFFER AMPL
Q47
A
PRIMARY REF PROP MOD FILTER
PART OF FL1
PRIMARY REF 30 HZ AMPL
Q3
PRIMARY REF 30 HZ AMPL
Q4
PRIMARY REF BUFFER AMPL
Q5
PRIMARY REF DIFFERENTIAL AMPL/PHASE SPLITTER
Q6–Q9
B
C
D
MONITOR REF PROP MOD FILTER
PART OF FL81
MONITOR REF 30 HZ AMPL
Q83
MONITOR REF 30 HZ AMPL
Q84
MONITOR REF BUFFER AMPL
Q85
MONITOR REF 30 HZ AMPL
Q86
MONITOR REF BUFFER AMPL
Q87
E
MONITOR VAR PROP MOD FILTER
PART OF FL121
MONITOR VAR 30 HZ AMPL
Q123
MONITOR VAR 30 HZ AMPL
Q124
MONITOR VAR BUFFER AMPL
Q125
MONITOR VAR DIFFERENTIAL AMPL/PHASE SPLITTER
Q126–Q129
F
G
H
TPO-4834-035



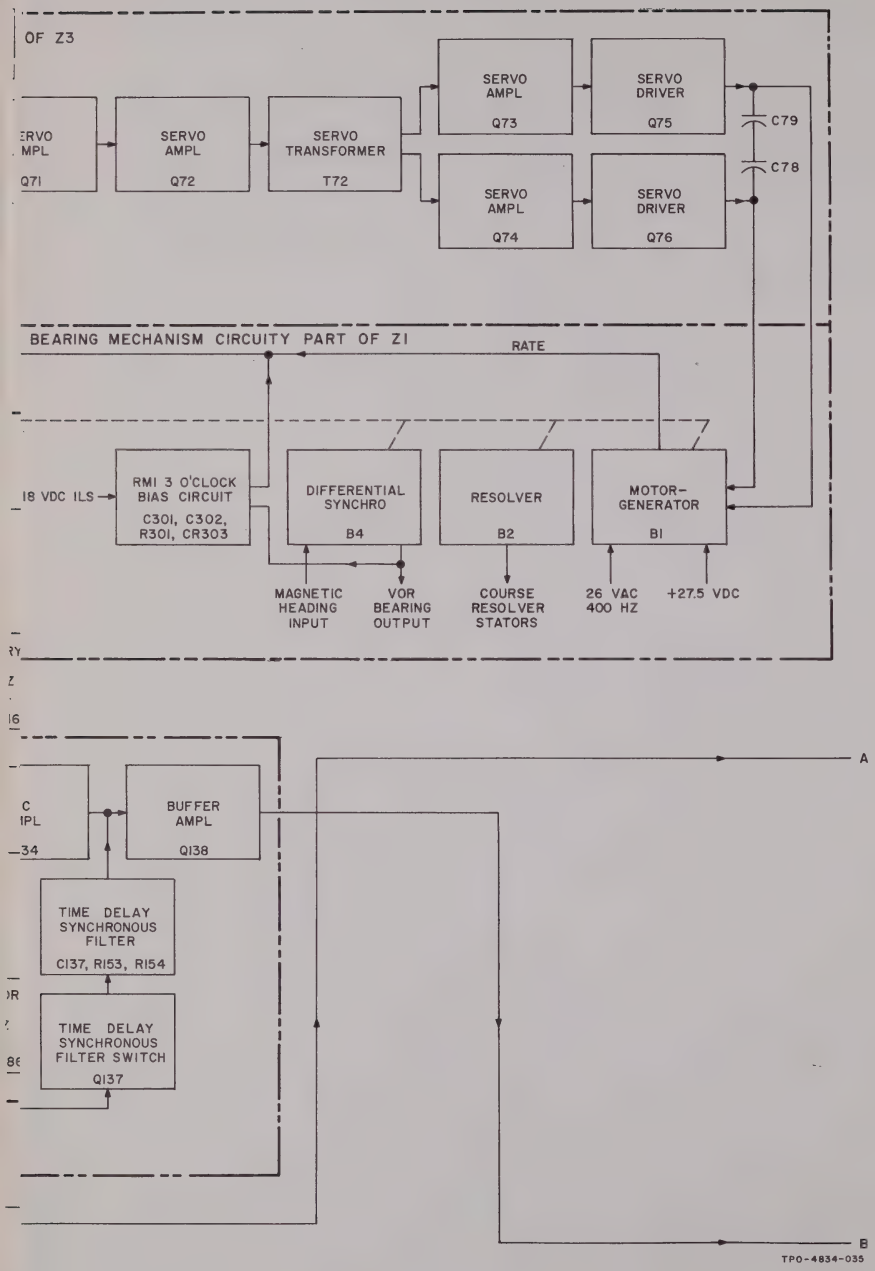
VOR/LOC Instrumentation Planar Assembly, Detailed Block Diagram (Sheet 2 of 3)
Figure 15


INPUT FROM DETECTOR ON VHF NAV RECEIVER PLANAR ASSEMBLY
9960 HZ FM PART OF Z3
PRIMARY REF 9960 HZ AMPL Q1
PRIMARY REF 9960 HZ AMPL Q2
PRIMARY REF 9960 HZ AMPL Q3
PRIMARY REF SLOPE DETECTOR Q4-Q6
MONITOR REF 9960 HZ AMPL Q101
MONITOR REF 9960 HZ AMPL Q102
MONITOR REF 9960 HZ AMPL Q103
MONITOR REF SLOPE DETECTOR Q104-Q106
PART OF Z1
PRIMARY VAR 30 HZ AMPL Q41
PRIMARY VAR 30 HZ AMPL Q42
PRIMARY VAR PROP MOD FILTER PART OF FL41
PRIMARY VAR 30 HZ AMPL Q43
PRIMARY VAR 30 HZ AMPL Q44
PRIMARY VAR BUFFER AMPL Q45
PRIMARY VAR 30 HZ AMPL Q46
PRIMARY VAR BUFFER AMPL Q47
A
PRIMARY REF 30 HZ AMPL Q1
PRIMARY REF 30 HZ AMPL Q2
PRIMARY REF BUFFER AMPL Q161
PRIMARY REF CONSTANT CURRENT DRIVER Q162
PRIMARY RESOLVER B3
PRIMARY REF 30 HZ AMPL Q164
PRIMARY REF 30 HZ AMPL Q165, Q166
PRIMARY REF PROP MOD FILTER PART OF FL1
PRIMARY REF 30 HZ AMPL Q3
PRIMARY REF 30 HZ AMPL Q4
PRIMARY REF BUFFER AMPL Q5
PRIMARY REF DIFFERENTIAL AMPL/PHASE SPLITTER Q6-Q9
B
C
D
MONITOR REF 30 HZ AMPL Q81
MONITOR REF 30 HZ AMPL Q82
MONITOR REF PROP MOD FILTER PART OF FL81
MONITOR REF 30 HZ AMPL Q83
MONITOR REF 30 HZ AMPL Q84
MONITOR REF BUFFER AMPL Q85
MONITOR REF 30 HZ AMPL Q86
MONITOR REF BUFFER AMPL Q87
E
MONITOR VAR 30 HZ AMPL Q121
MONITOR VAR 30 HZ AMPL Q122
MONITOR VAR BUFFER AMPL Q181
MONITOR VAR CONSTANT CURRENT DRIVER Q182
MONITOR RESOLVER B5
MONITOR VAR 30 HZ AMPL Q184
MONITOR VAR 30 HZ AMPL Q185, Q186
MONITOR VAR PROP MOD FILTER PART OF FL121
MONITOR VAR 30 HZ AMPL Q123
MONITOR VAR 30 HZ AMPL Q124
MONITOR VAR BUFFER AMPL Q125
MONITOR VAR DIFFERENTIAL AMPL/PHASE SPLITTER Q126-Q129
F
G
H
TPO-4834-035

VOR/LOC Instrumentation Planar Assembly, Detailed Block Diagram (Sheet 1 of 3)
Figure 15



VOR/LOC Instrumentation Planar Assembly, Detailed Block Diagram (Sheet 2 of 3)
Figure 15


OF Z3
SERVO AMPL Q71
SERVO AMPL Q72
SERVO TRANSFORMER T72
SERVO AMPL Q73
SERVO AMPL Q74
SERVO DRIVER Q75
SERVO DRIVER Q76
C79
C78
BEARING MECHANISM CIRCUITY PART OF Z1
RATE
18 VDC ILS
RMI 3 O'CLOCK BIAS CIRCUIT C301, C302, R301, CR303
DIFFERENTIAL SYNCHRO B4
RESOLVER B2
MOTOR-GENERATOR B1
MAGNETIC HEADING INPUT
VOR BEARING OUTPUT
COURSE RESOLVER STATORS
26 VAC 400 HZ
+27.5 VDC
BUFFER AMPL Q138
TIME DELAY SYNCHRONOUS FILTER C137, R153, R154
TIME DELAY SYNCHRONOUS FILTER SWITCH Q137
A
B

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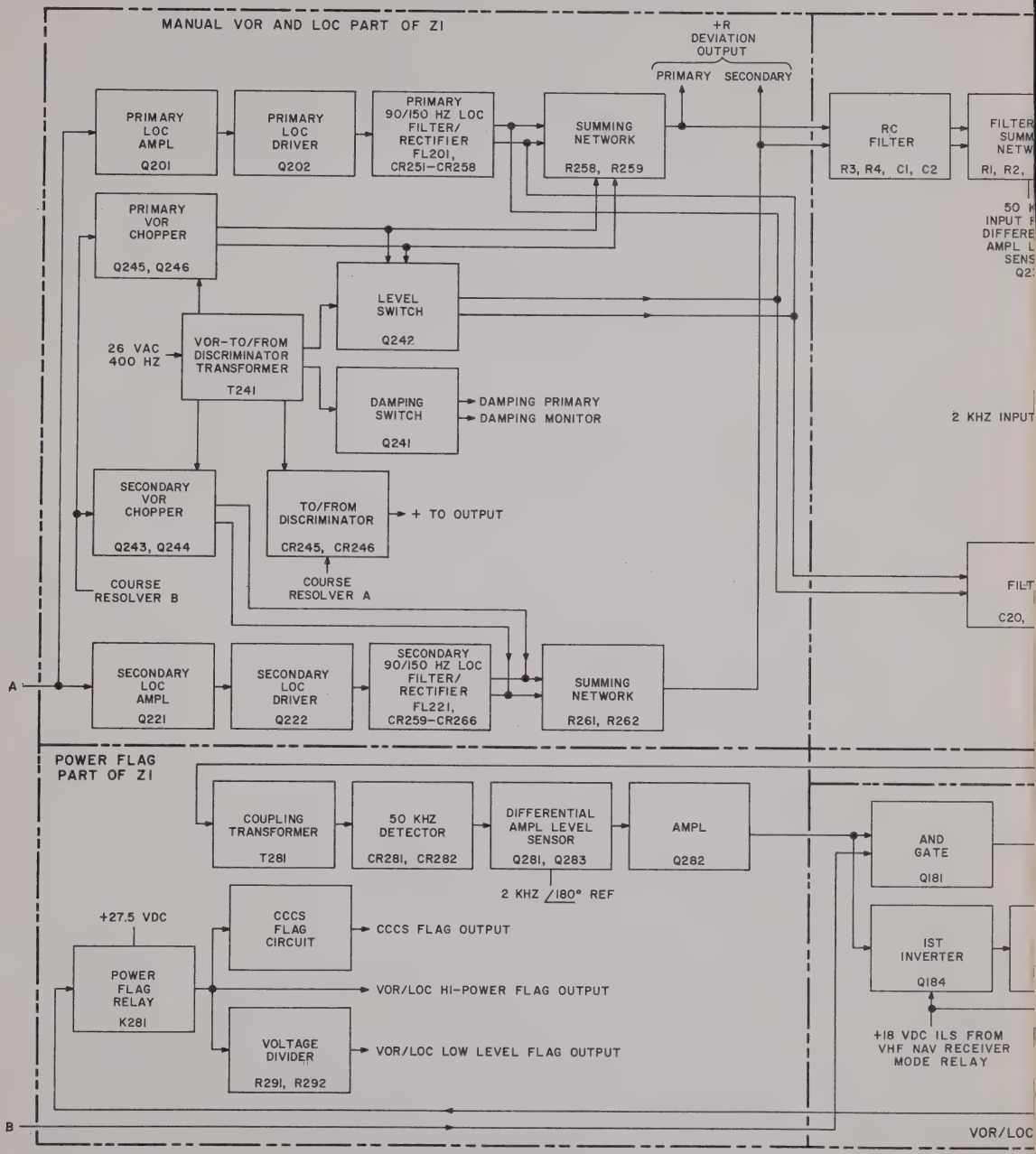
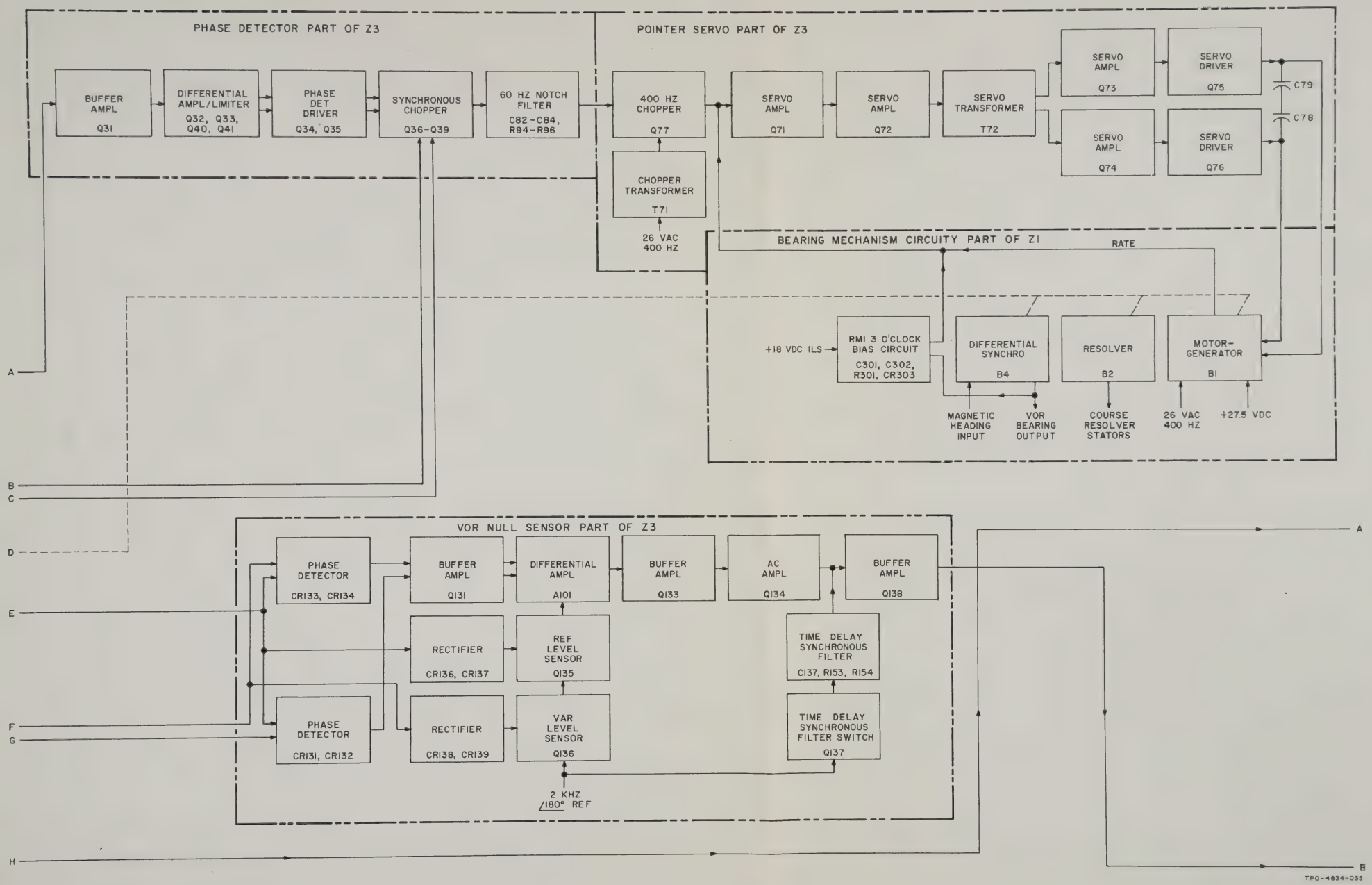
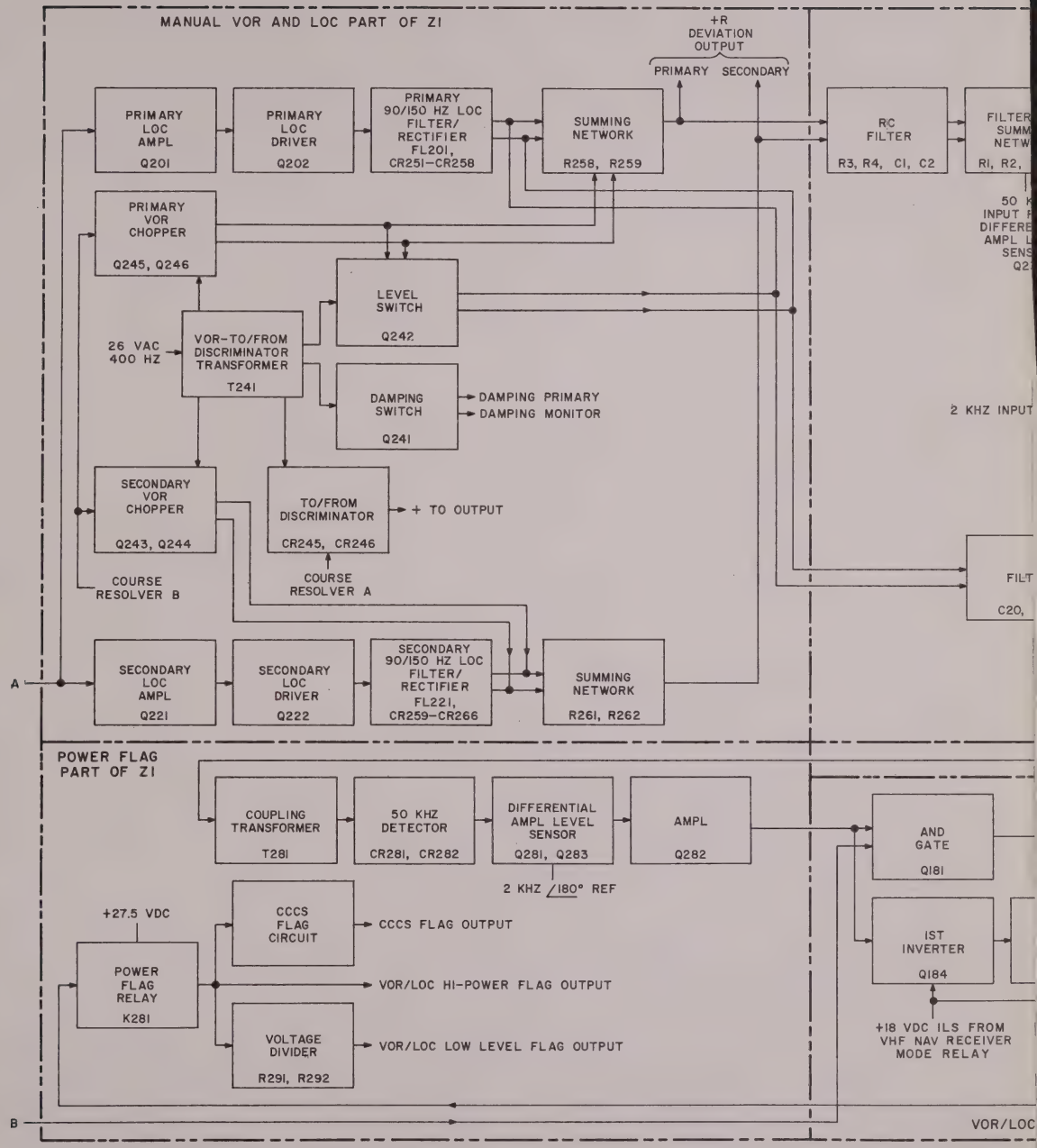


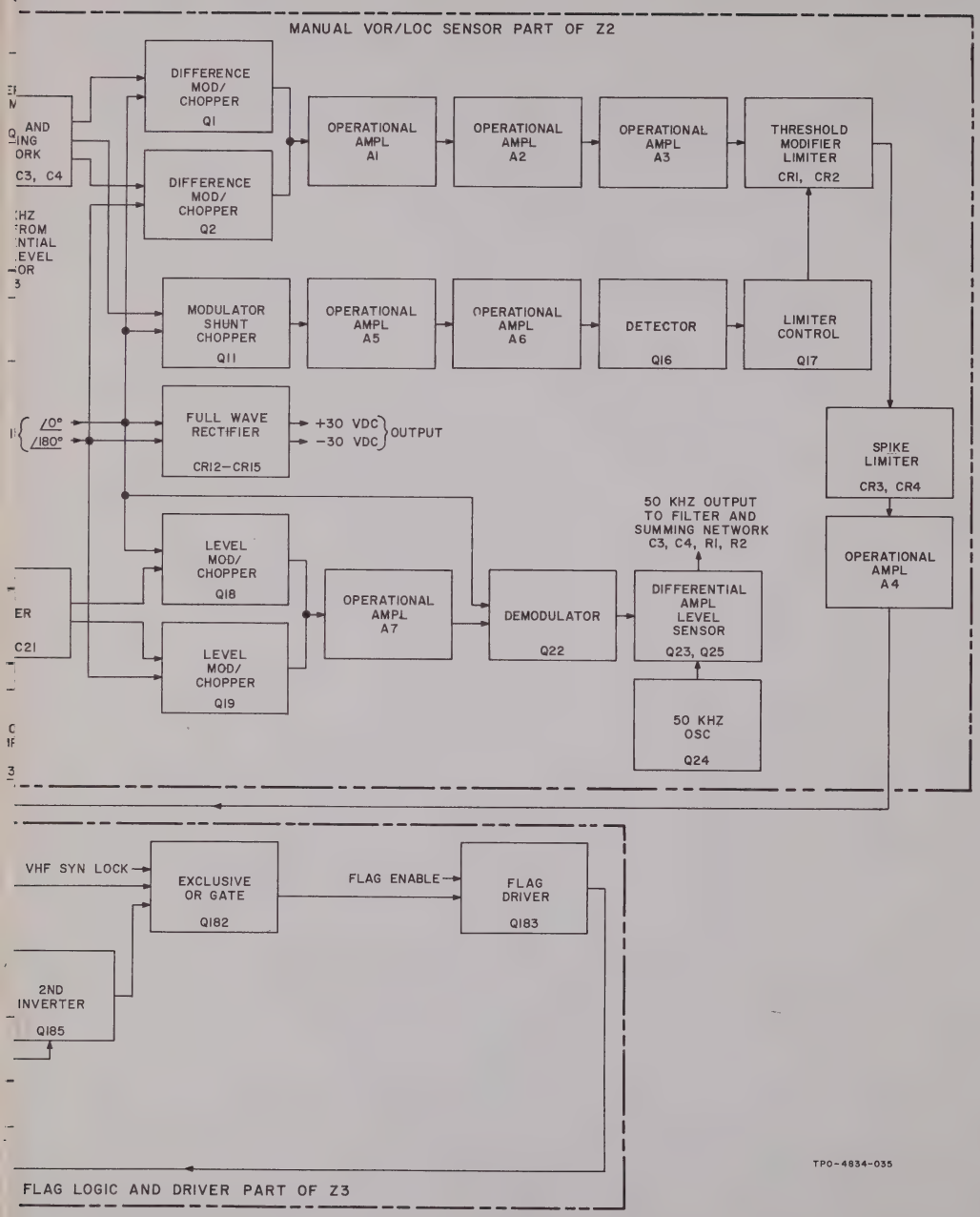
VOR/LOC Instrumentation Planar Assembly, Detailed Block Diagram (Sheet 3 of 3)
Figure 15



VOR/LOC Instrumentation Planar Assembly, Detailed Block Diagram (Sheet 2 of 3)
Figure 15



VOR/LOC Instrumentation Planar Assembly, Detailed Block Diagram (Sheet 3 of 3)
Figure 15


MANUAL VOR/LOC SENSOR PART OF Z2
DIFFERENCE MOD/ CHOPPER Q1
DIFFERENCE MOD/ CHOPPER Q2
OPERATIONAL AMPL A1
OPERATIONAL AMPL A2
OPERATIONAL AMPL A3
THRESHOLD MODIFIER LIMITER CR1, CR2
MODULATOR SHUNT CHOPPER Q11
OPERATIONAL AMPL A5
OPERATIONAL AMPL A6
DETECTOR Q16
LIMITER CONTROL Q17
FULL WAVE RECTIFIER CR12–CR15
+30 VDC
-30 VDC
OUTPUT
SPIKE LIMITER CR3, CR4
OPERATIONAL AMPL A4
50 KHZ OUTPUT TO FILTER AND SUMMING NETWORK C3, C4, R1, R2
LEVEL MOD/ CHOPPER Q18
LEVEL MOD/ CHOPPER Q19
OPERATIONAL AMPL A7
DEMODULATOR Q22
DIFFERENTIAL AMPL LEVEL SENSOR Q23, Q25
50 KHZ OSC Q24
C3, C4
C21
VHF SYN LOCK
EXCLUSIVE OR GATE Q182
FLAG ENABLE
FLAG DRIVER Q183
2ND INVERTER Q185
FLAG LOGIC AND DRIVER PART OF Z3

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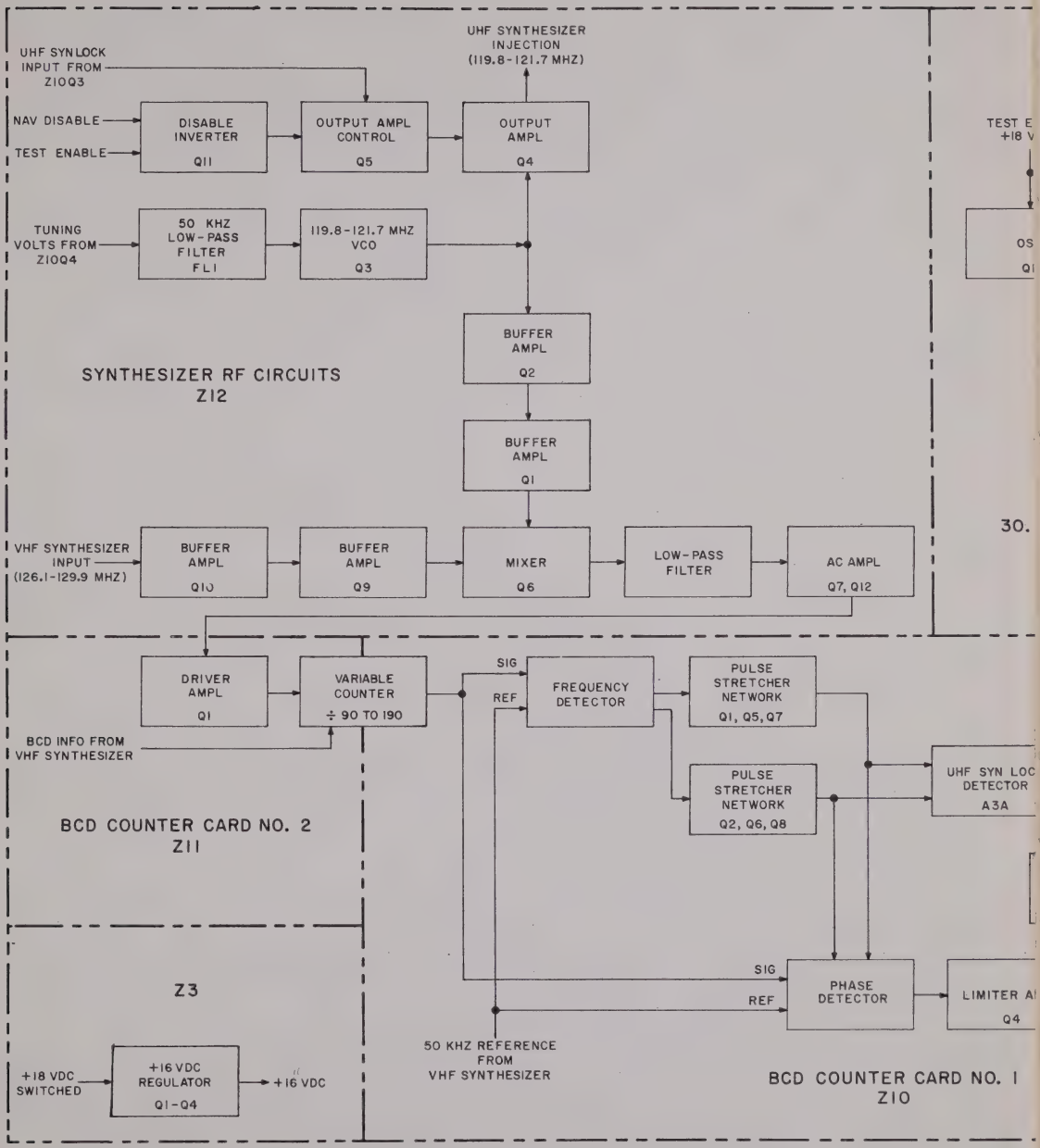
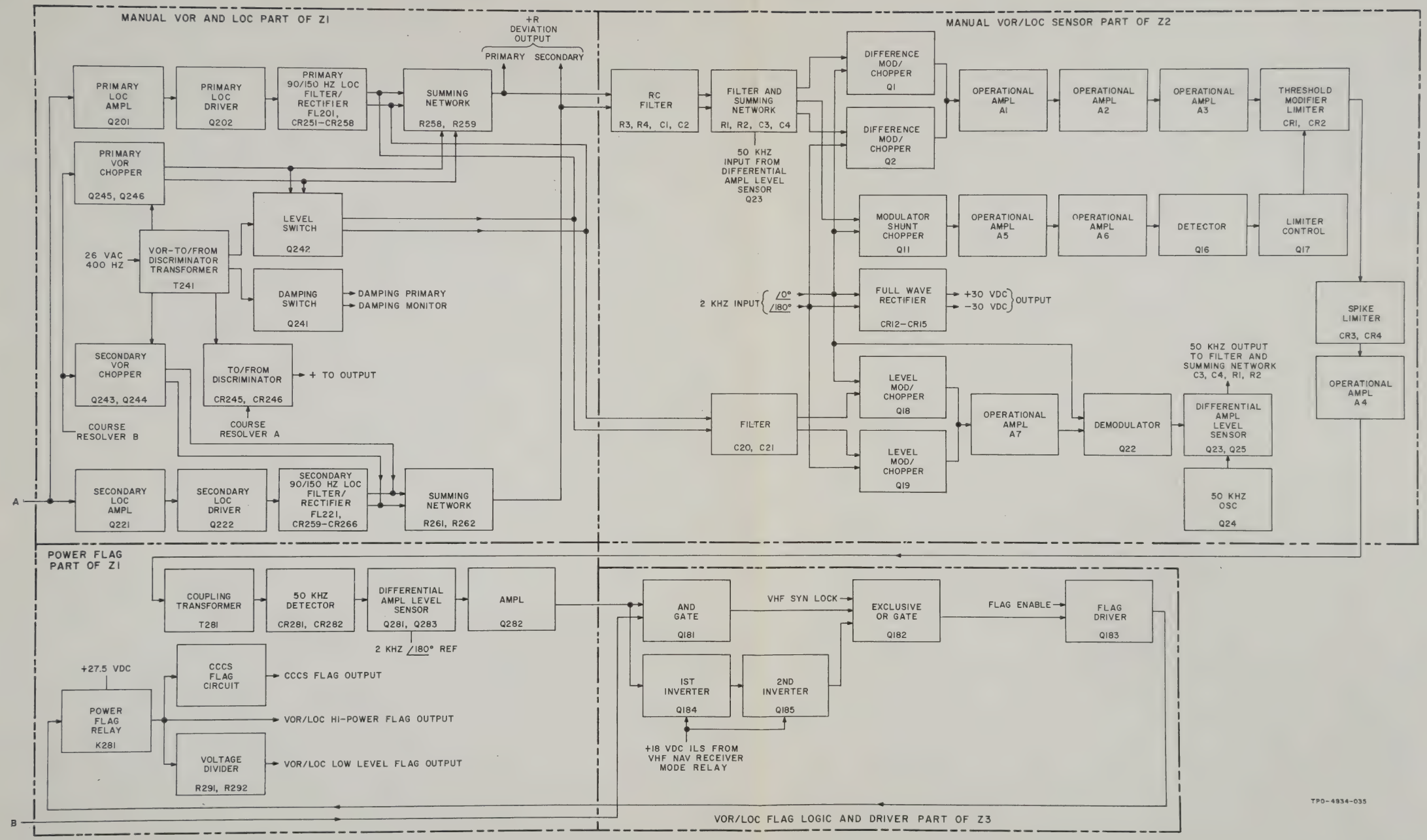
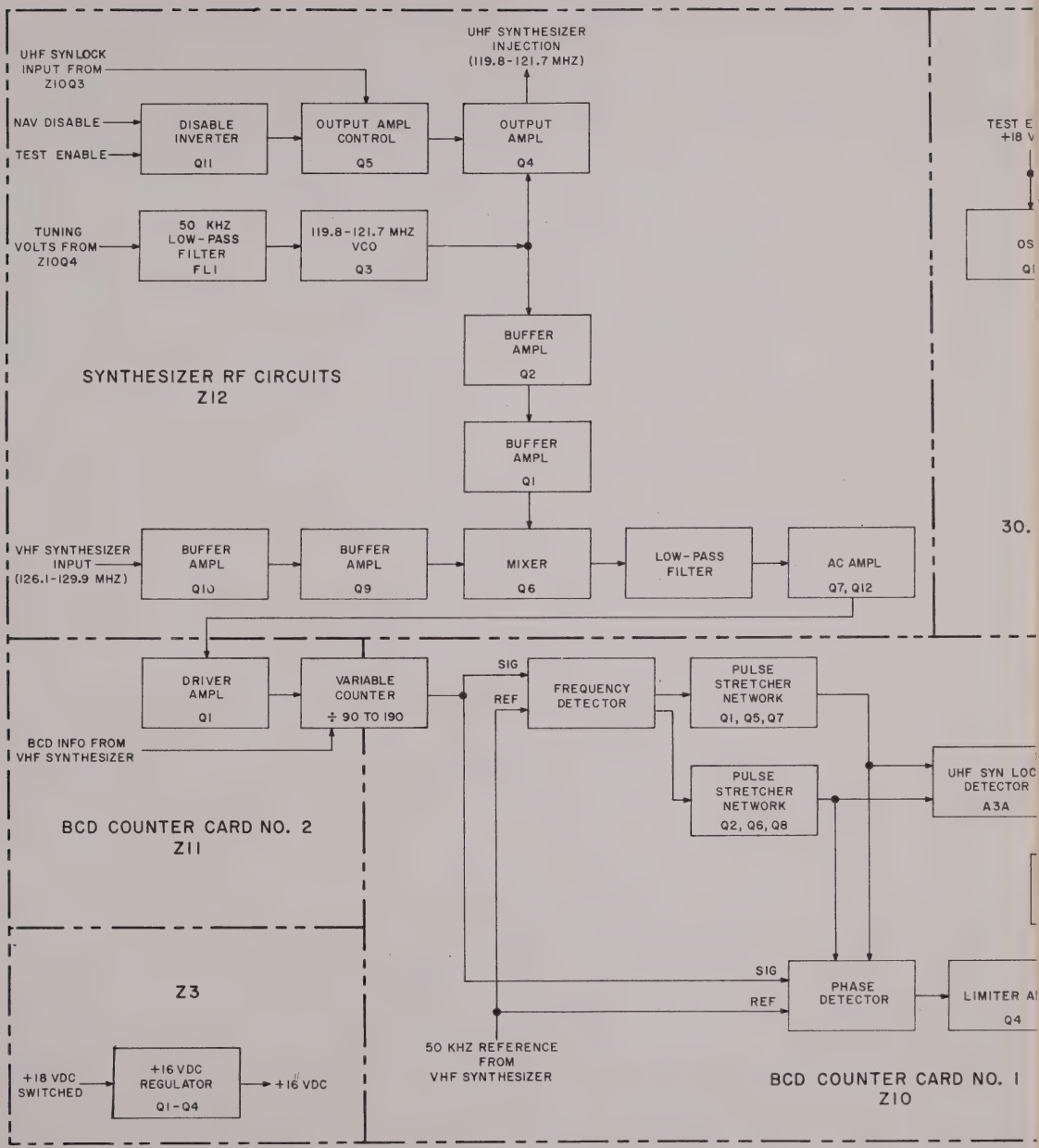


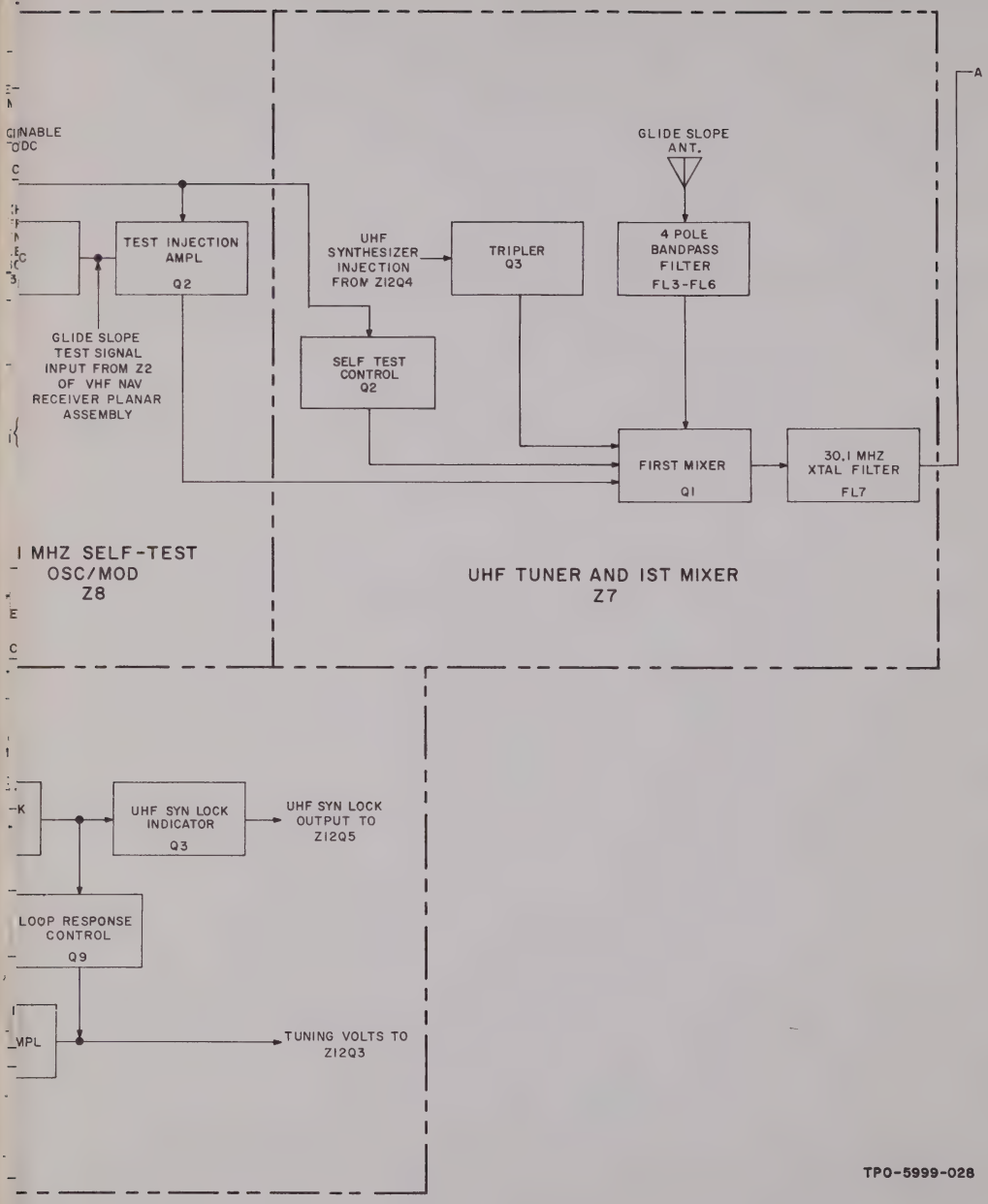
Glideslope Receiver Planar Assembly, Detailed Block Diagram Without One Piece UHF Front End Casting (Sheet 1 of 3)
Figure 16



VOR/LOC Instrumentation Planar Assembly, Detailed Block Diagram (Sheet 3 of 3)
Figure 15



Glideslope Receiver Planar Assembly, Detailed Block Diagram Without One Piece UHF Front End Casting (Sheet 1 of 3)
Figure 16


A
GLIDE SLOPE ANT.
TEST INJECTION AMPL Q2
UHF SYNTHESIZER INJECTION FROM Z12Q4
TRIPLER Q3
4 POLE BANDPASS FILTER FL3-FL6
GLIDE SLOPE TEST SIGNAL INPUT FROM Z2 OF VHF NAV RECEIVER PLANAR ASSEMBLY
SELF TEST CONTROL Q2
FIRST MIXER Q1
30.1 MHZ XTAL FILTER FL7
I MHZ SELF-TEST OSC/MOD Z8
UHF TUNER AND IST MIXER Z7
UHF SYN LOCK INDICATOR Q3
UHF SYN LOCK OUTPUT TO Z12Q5
LOOP RESPONSE CONTROL Q9
TUNING VOLTS TO Z12Q3

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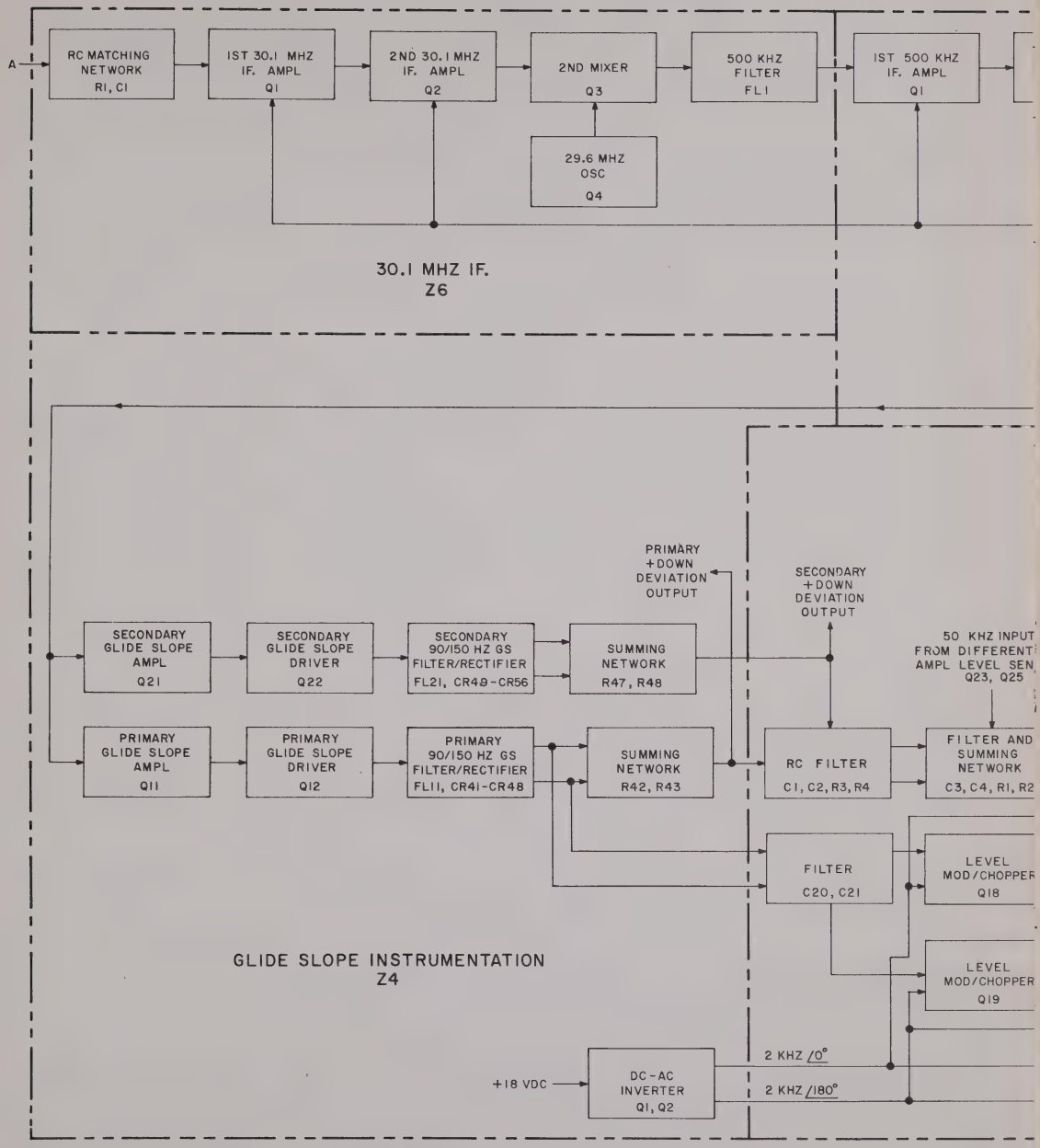
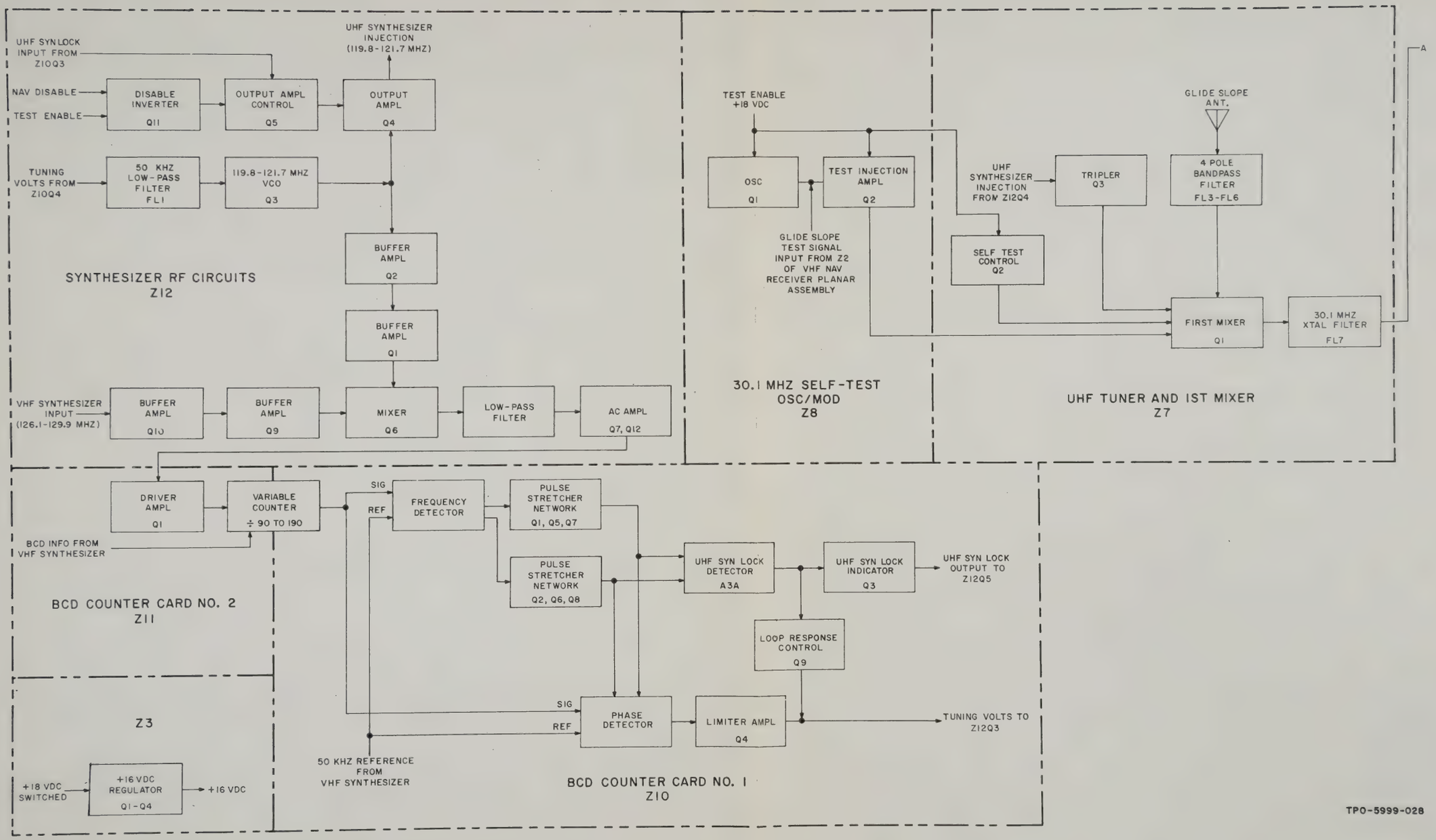
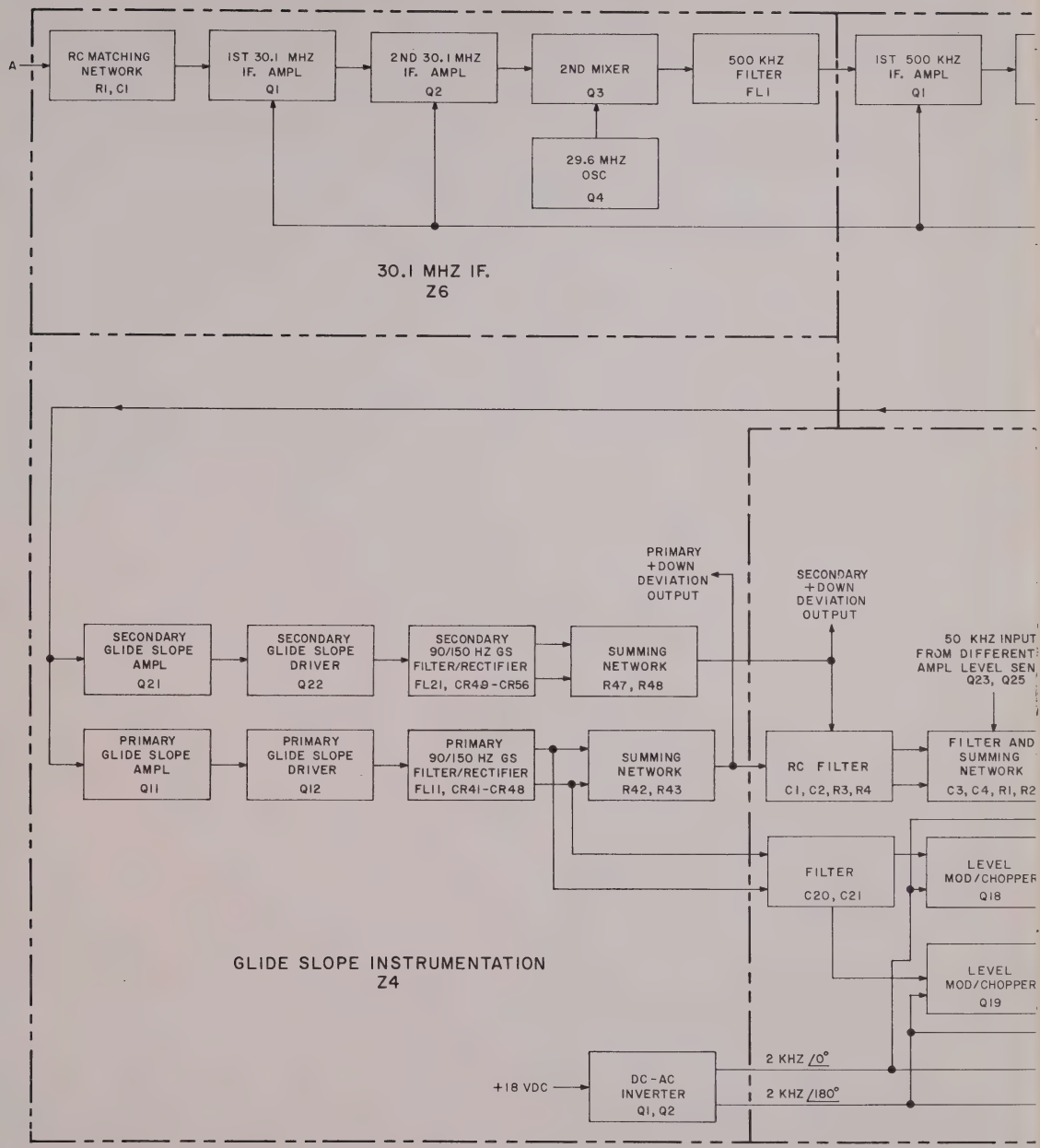

A
RC MATCHING NETWORK R1, C1
1ST 30.1 MHZ IF. AMPL Q1
2ND 30.1 MHZ IF. AMPL Q2
2ND MIXER Q3
29.6 MHZ OSC Q4
500 KHZ FILTER FL1
1ST 500 KHZ IF. AMPL Q1
30.1 MHZ IF. Z6
PRIMARY +DOWN DEVIATION OUTPUT
SECONDARY +DOWN DEVIATION OUTPUT
50 KHZ INPUT FROM DIFFERENT AMPL LEVEL SEN Q23, Q25
SECONDARY GLIDE SLOPE AMPL Q21
SECONDARY GLIDE SLOPE DRIVER Q22
SECONDARY 90/150 HZ GS FILTER/RECTIFIER FL21, CR49-CR56
SUMMING NETWORK R47, R48
PRIMARY GLIDE SLOPE AMPL Q11
PRIMARY GLIDE SLOPE DRIVER Q12
PRIMARY 90/150 HZ GS FILTER/RECTIFIER FL11, CR41-CR48
SUMMING NETWORK R42, R43
RC FILTER C1, C2, R3, R4
FILTER AND SUMMING NETWORK C3, C4, R1, R2
FILTER C20, C21
LEVEL MOD/CHOPPER Q18
LEVEL MOD/CHOPPER Q19
GLIDE SLOPE INSTRUMENTATION Z4
+18 VDC
DC-AC INVERTER Q1, Q2
2 KHZ /0°
2 KHZ /180°

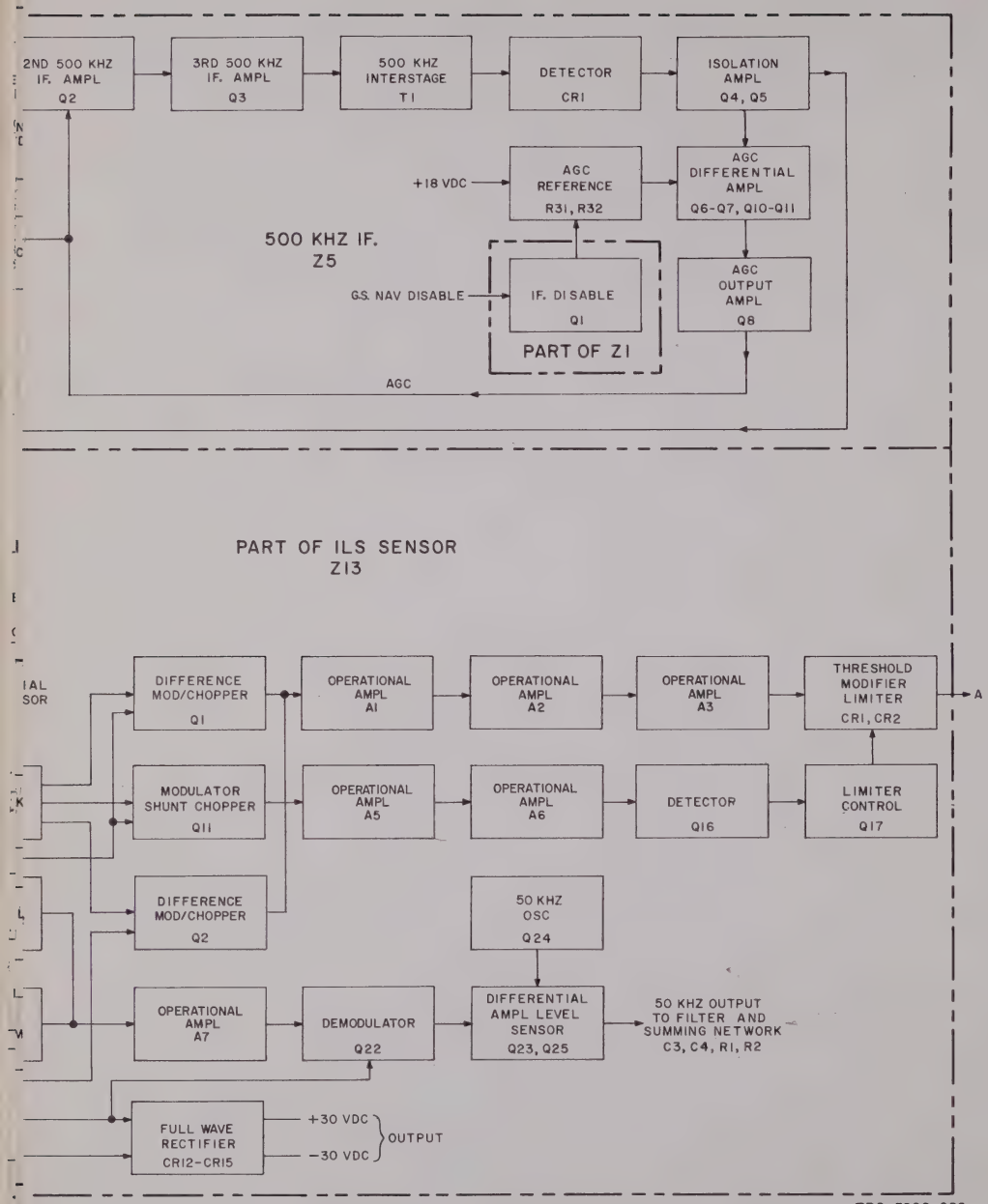
Glideslope Receiver Planar Assembly, Detailed Block Diagram Without One Piece UHF Front End Casting (Sheet 2 of 3)
Figure 16



Glideslope Receiver Planar Assembly, Detailed Block Diagram Without One Piece UHF Front End Casting (Sheet 1 of 3)
Figure 16


A
RC MATCHING NETWORK R1, C1
1ST 30.1 MHZ IF. AMPL Q1
2ND 30.1 MHZ IF. AMPL Q2
2ND MIXER Q3
29.6 MHZ OSC Q4
500 KHZ FILTER FL1
1ST 500 KHZ IF. AMPL Q1
30.1 MHZ IF. Z6
PRIMARY +DOWN DEVIATION OUTPUT
SECONDARY +DOWN DEVIATION OUTPUT
SECONDARY GLIDE SLOPE AMPL Q21
SECONDARY GLIDE SLOPE DRIVER Q22
SECONDARY 90/150 HZ GS FILTER/RECTIFIER FL21, CR49-CR56
SUMMING NETWORK R47, R48
50 KHZ INPUT FROM DIFFERENT AMPL LEVEL SEN Q23, Q25
PRIMARY GLIDE SLOPE AMPL Q11
PRIMARY GLIDE SLOPE DRIVER Q12
PRIMARY 90/150 HZ GS FILTER/RECTIFIER FL11, CR41-CR48
SUMMING NETWORK R42, R43
RC FILTER C1, C2, R3, R4
FILTER AND SUMMING NETWORK C3, C4, R1, R2
FILTER C20, C21
LEVEL MOD/CHOPPER Q18
LEVEL MOD/CHOPPER Q19
GLIDE SLOPE INSTRUMENTATION Z4
+18 VDC
DC-AC INVERTER Q1, Q2
2 KHZ /0°
2 KHZ /180°

Glideslope Receiver Planar Assembly, Detailed Block Diagram Without One Piece UHF Front End Casting (Sheet 2 of 3)
Figure 16


2ND 500 KHZ IF. AMPL Q2
3RD 500 KHZ IF. AMPL Q3
500 KHZ INTERSTAGE T1
DETECTOR CR1
ISOLATION AMPL Q4, Q5
+18 VDC
AGC REFERENCE R31, R32
AGC DIFFERENTIAL AMPL Q6-Q7, Q10-Q11
500 KHZ IF. Z5
G.S. NAV DISABLE
IF. DISABLE Q1
AGC OUTPUT AMPL Q8
PART OF Z1
AGC
PART OF ILS SENSOR Z13
DIFFERENCE MOD/CHOPPER Q1
OPERATIONAL AMPL A1
OPERATIONAL AMPL A2
OPERATIONAL AMPL A3
THRESHOLD MODIFIER LIMITER CR1, CR2
MODULATOR SHUNT CHOPPER Q11
OPERATIONAL AMPL A5
OPERATIONAL AMPL A6
DETECTOR Q16
LIMITER CONTROL Q17
DIFFERENCE MOD/CHOPPER Q2
50 KHZ OSC Q24
OPERATIONAL AMPL A7
DEMODULATOR Q22
DIFFERENTIAL AMPL LEVEL SENSOR Q23, Q25
50 KHZ OUTPUT TO FILTER AND SUMMING NETWORK C3, C4, R1, R2
FULL WAVE RECTIFIER CR12-CR15
+30 VDC
-30 VDC
OUTPUT

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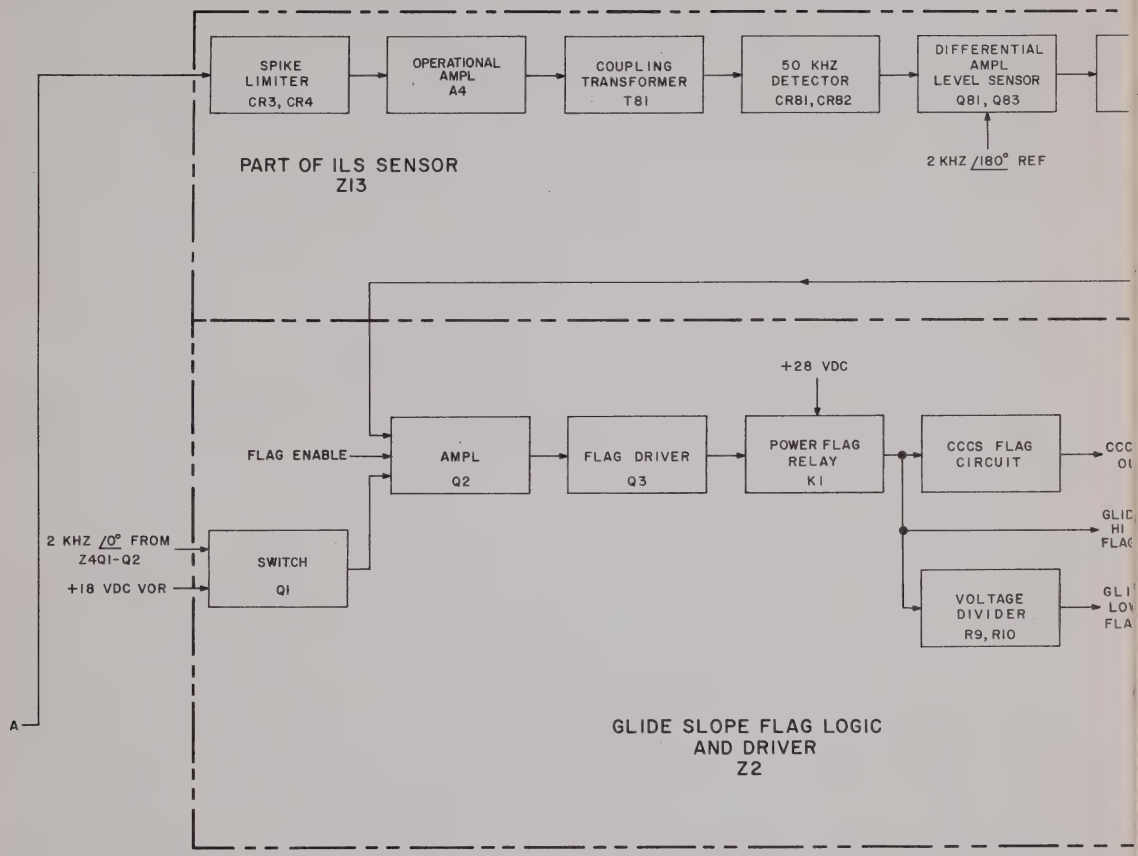
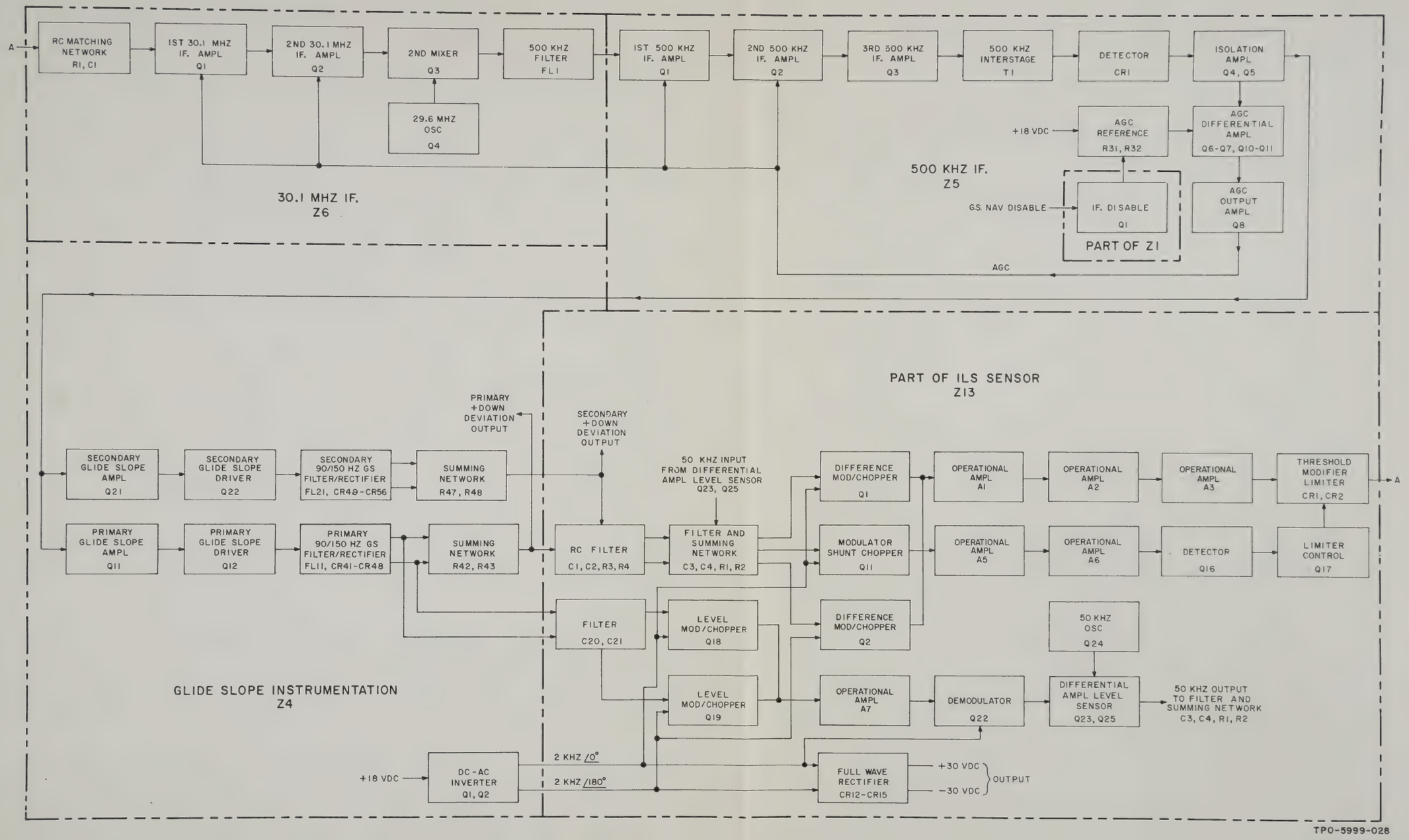
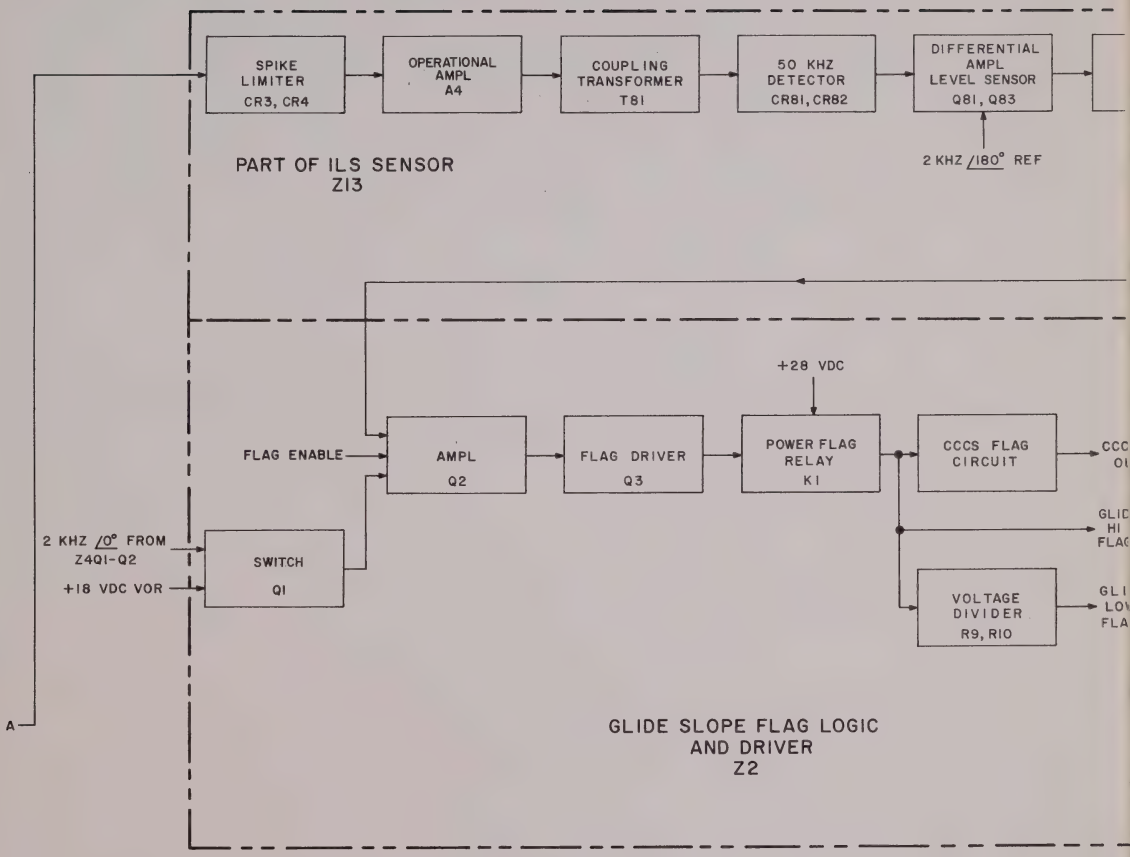


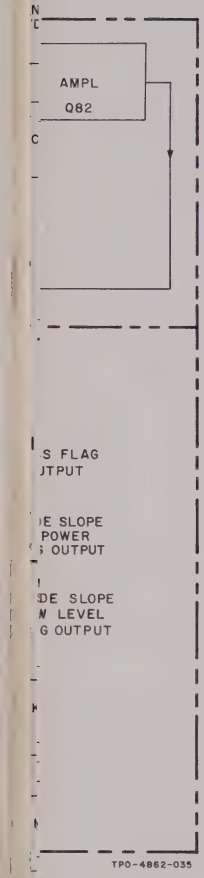
Glideslope Receiver Planar Assembly, Detailed Block Diagram Without One Piece UHF Front End Casting (Sheet 3 of 3)
Figure 16

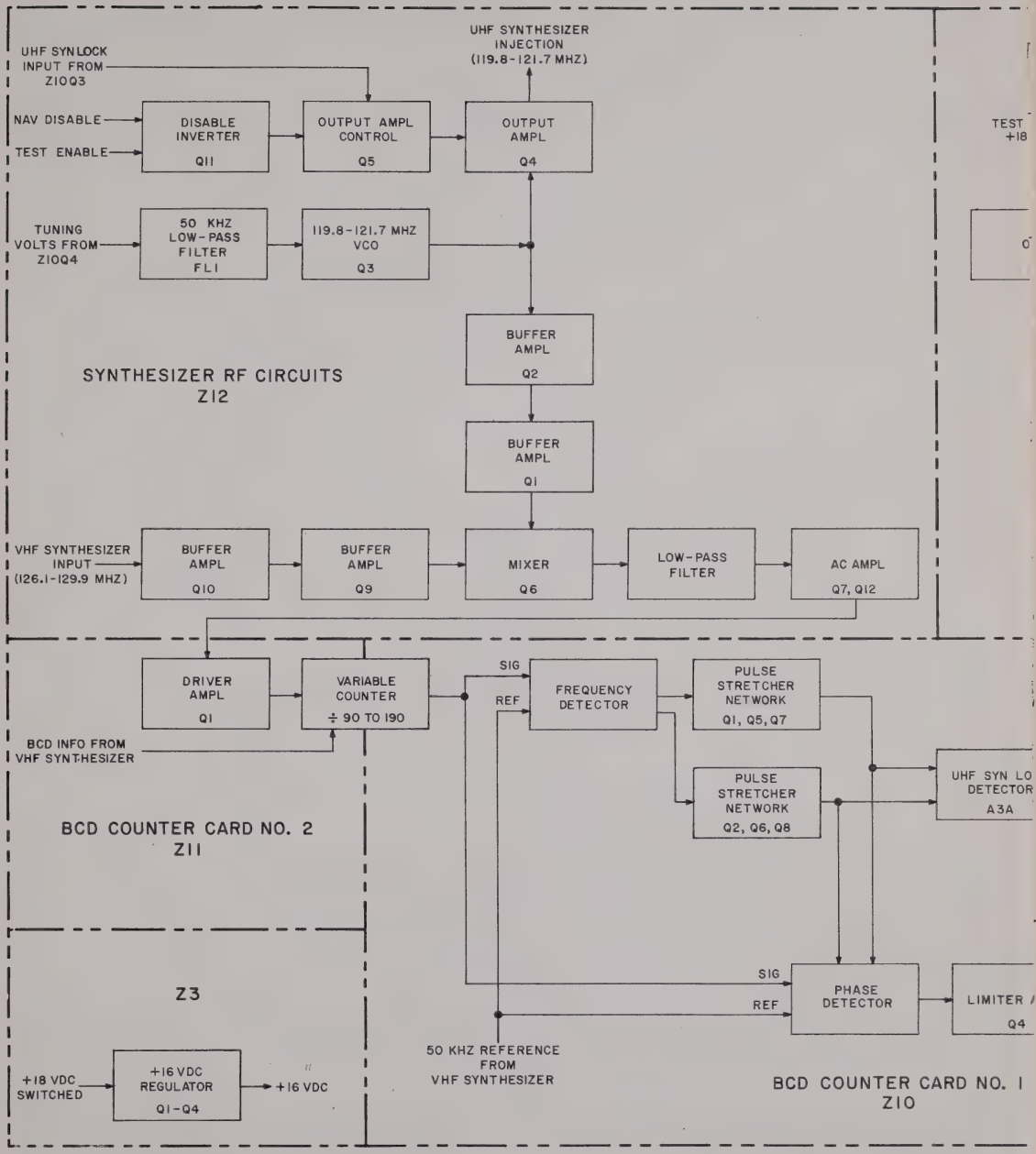

A
RC MATCHING NETWORK R1, C1
1ST 30.1 MHZ IF. AMPL Q1
2ND 30.1 MHZ IF. AMPL Q2
2ND MIXER Q3
29.6 MHZ OSC Q4
500 KHZ FILTER FL1
30.1 MHZ IF. Z6
1ST 500 KHZ IF. AMPL Q1
2ND 500 KHZ IF. AMPL Q2
3RD 500 KHZ IF. AMPL Q3
500 KHZ INTERSTAGE T1
DETECTOR CR1
ISOLATION AMPL Q4, Q5
+18 VDC
AGC REFERENCE R31, R32
AGC DIFFERENTIAL AMPL Q6-Q7, Q10-Q11
500 KHZ IF. Z5
G.S. NAV DISABLE
IF. DISABLE Q1
PART OF Z1
AGC OUTPUT AMPL Q8
AGC
PART OF ILS SENSOR Z13
PRIMARY +DOWN DEVIATION OUTPUT
SECONDARY +DOWN DEVIATION OUTPUT
50 KHZ INPUT FROM DIFFERENTIAL AMPL LEVEL SENSOR Q23, Q25
SECONDARY GLIDE SLOPE AMPL Q21
SECONDARY GLIDE SLOPE DRIVER Q22
SECONDARY 90/150 HZ GS FILTER/RECTIFIER FL21, CR49-CR56
SUMMING NETWORK R47, R48
PRIMARY GLIDE SLOPE AMPL Q11
PRIMARY GLIDE SLOPE DRIVER Q12
PRIMARY 90/150 HZ GS FILTER/RECTIFIER FL11, CR41-CR48
SUMMING NETWORK R42, R43
RC FILTER C1, C2, R3, R4
FILTER AND SUMMING NETWORK C3, C4, R1, R2
FILTER C20, C21
LEVEL MOD/CHOPPER Q18
LEVEL MOD/CHOPPER Q19
DIFFERENCE MOD/CHOPPER Q1
MODULATOR SHUNT CHOPPER Q11
DIFFERENCE MOD/CHOPPER Q2
OPERATIONAL AMPL A7
OPERATIONAL AMPL A1
OPERATIONAL AMPL A2
OPERATIONAL AMPL A3
OPERATIONAL AMPL A5
OPERATIONAL AMPL A6
THRESHOLD MODIFIER LIMITER CR1, CR2
DETECTOR Q16
LIMITER CONTROL Q17
50 KHZ OSC Q24
DEMODULATOR Q22
DIFFERENTIAL AMPL LEVEL SENSOR Q23, Q25
50 KHZ OUTPUT TO FILTER AND SUMMING NETWORK C3, C4, R1, R2
GLIDE SLOPE INSTRUMENTATION Z4
+18 VDC
DC-AC INVERTER Q1, Q2
2 KHZ /0°
2 KHZ /180°
FULL WAVE RECTIFIER CR12-CR15
+30 VDC
-30 VDC
OUTPUT
TP0-5999-028

Glideslope Receiver Planar Assembly, Detailed Block Diagram Without One Piece UHF Front End Casting (Sheet 2 of 3)
Figure 16

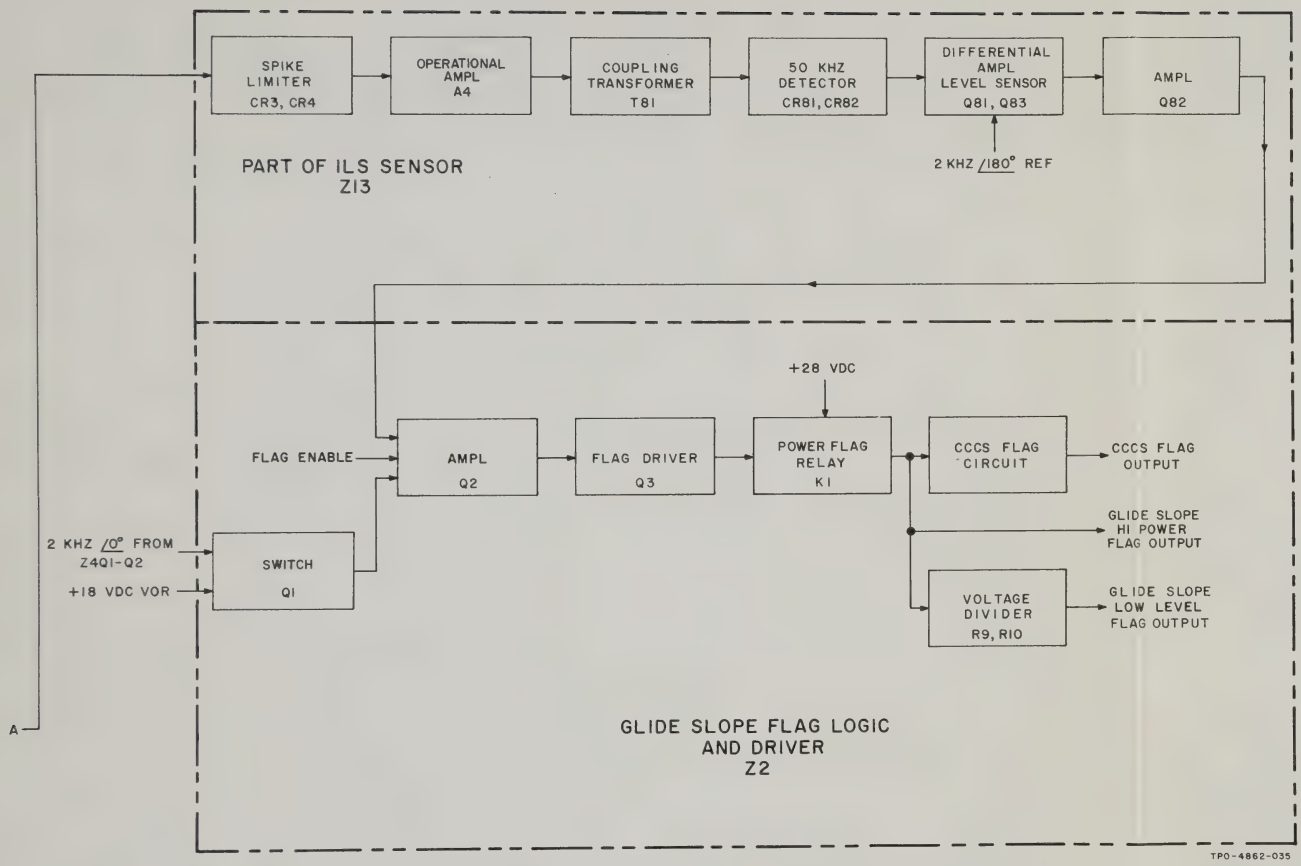


Glideslope Receiver Planar Assembly, Detailed Block Diagram Without One Piece UHF Front End Casting (Sheet 3 of 3)
Figure 16

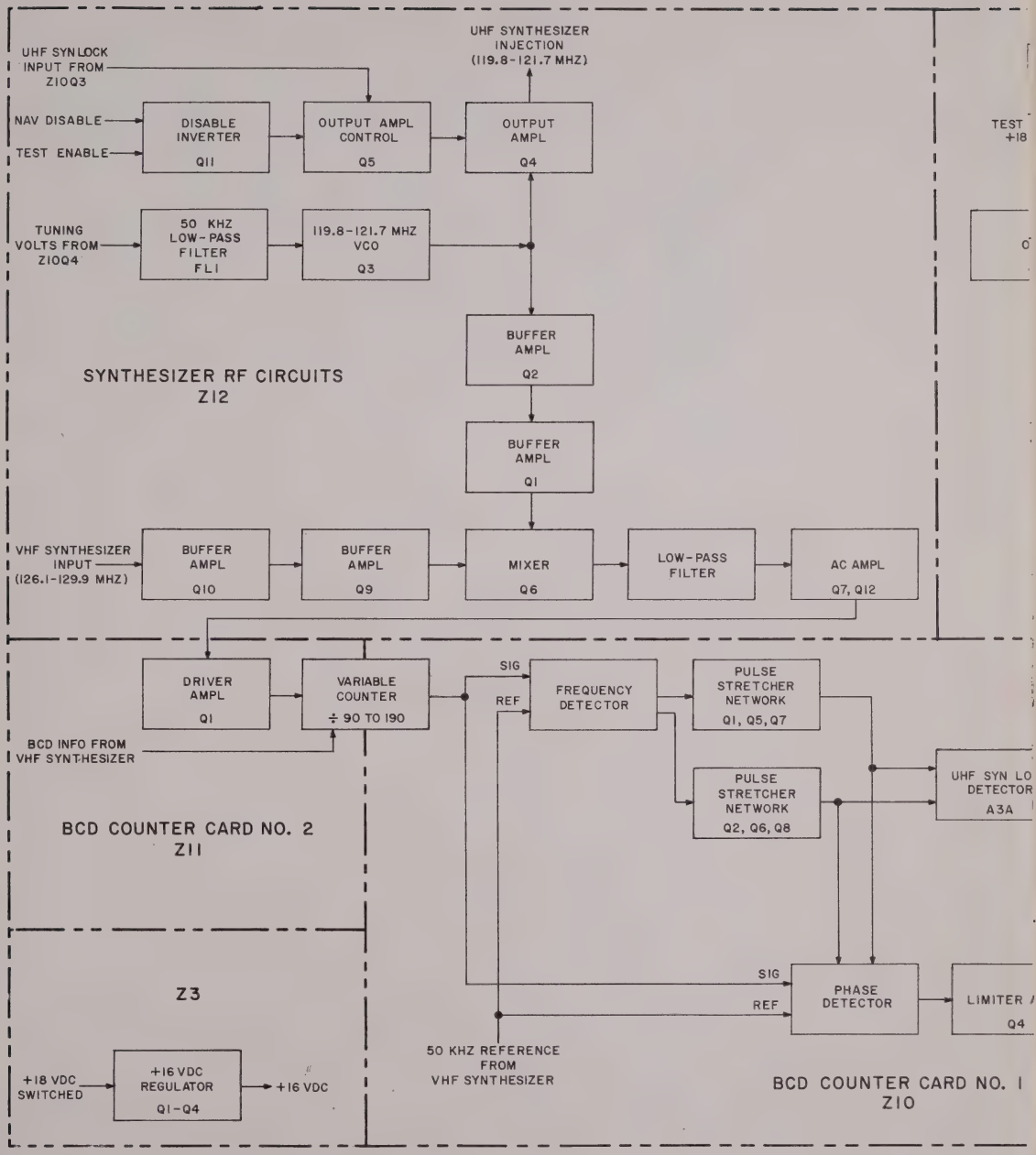

AMPL
Q82
S FLAG
JTPUT
E SLOPE
POWER
OUTPUT
DE SLOPE
N LEVEL
G OUTPUT
TP0-4862-035



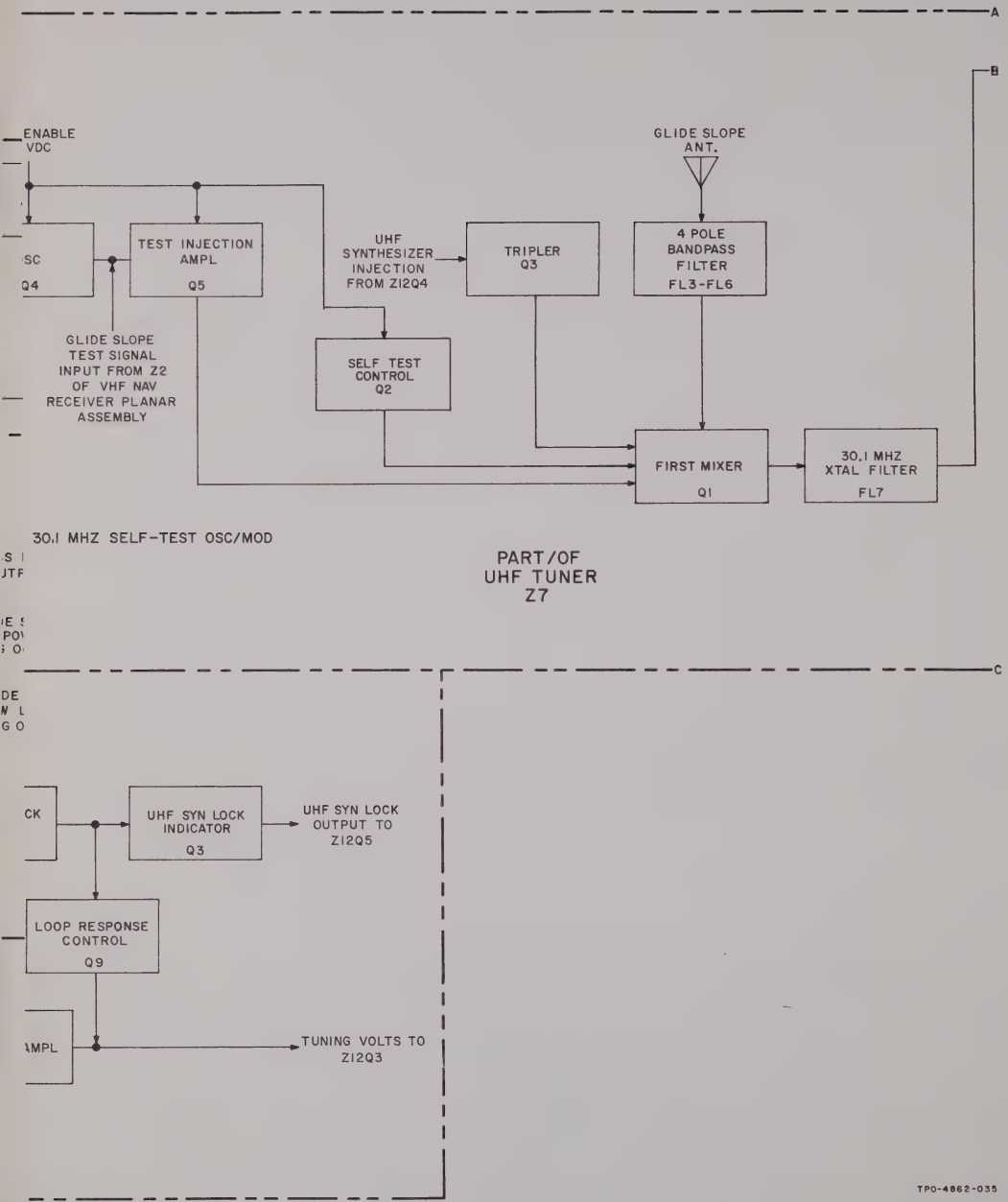
Glideslope Receiver Planar Assembly, Detailed Block Diagram With One Piece UHF Front End Casting (Sheet 1 of 3)
Figure 17

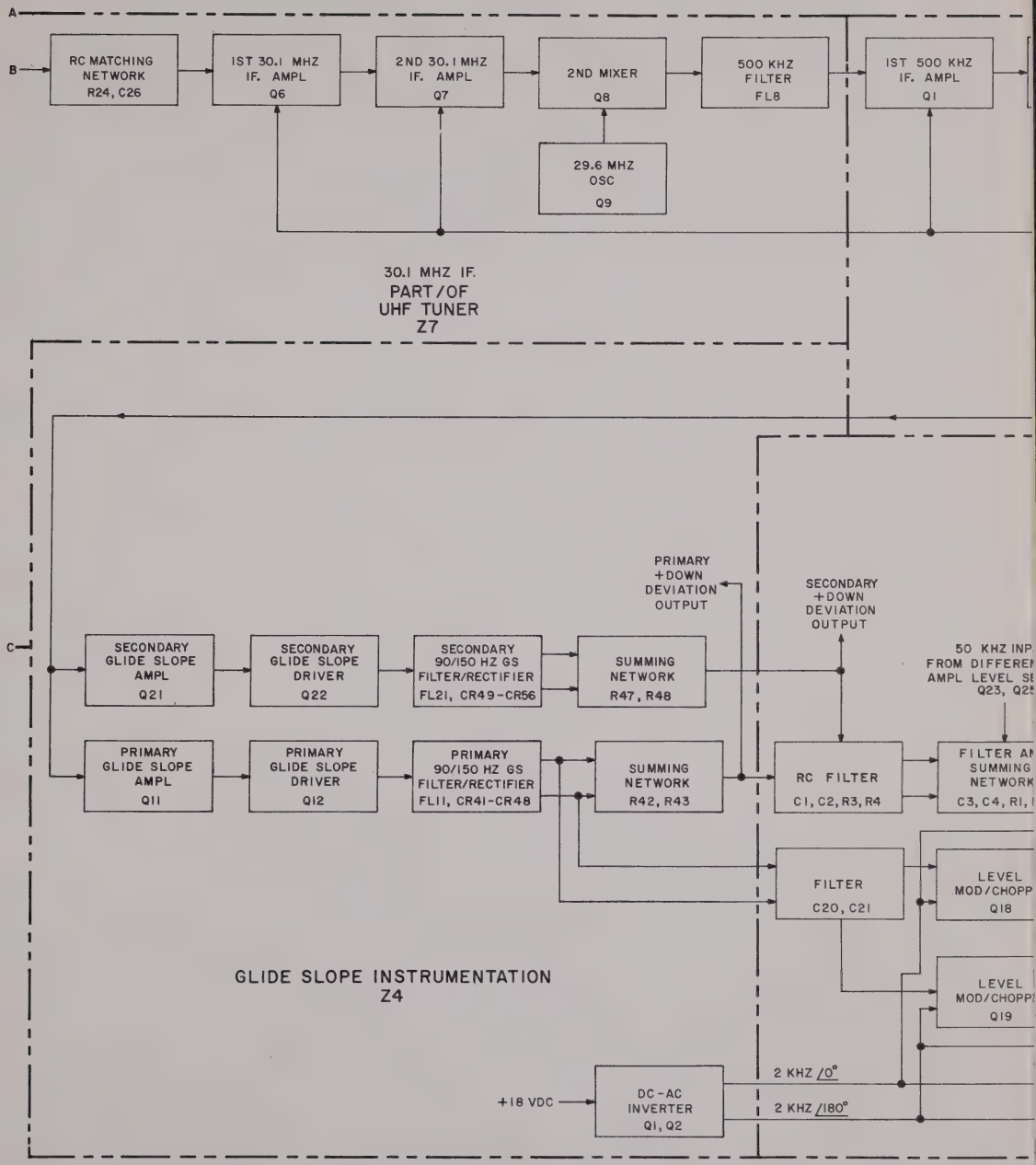


Glideslope Receiver Planar Assembly, Detailed Block Diagram Without One Piece UHF Front End Casting (Sheet 3 of 3)
Figure 16

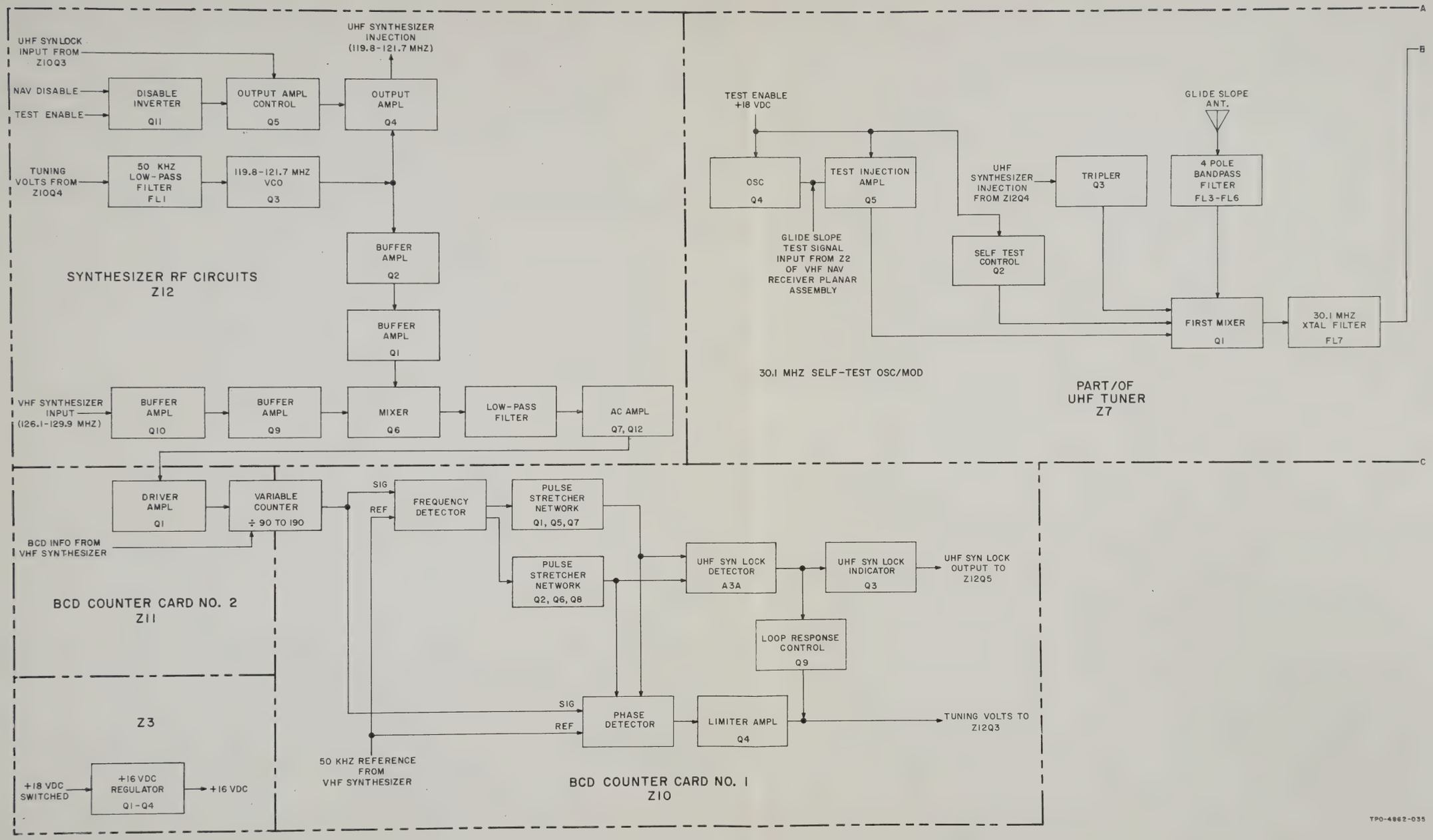


Glideslope Receiver Planar Assembly, Detailed Block Diagram With One Piece UHF Front End Casting (Sheet 1 of 3)
Figure 17

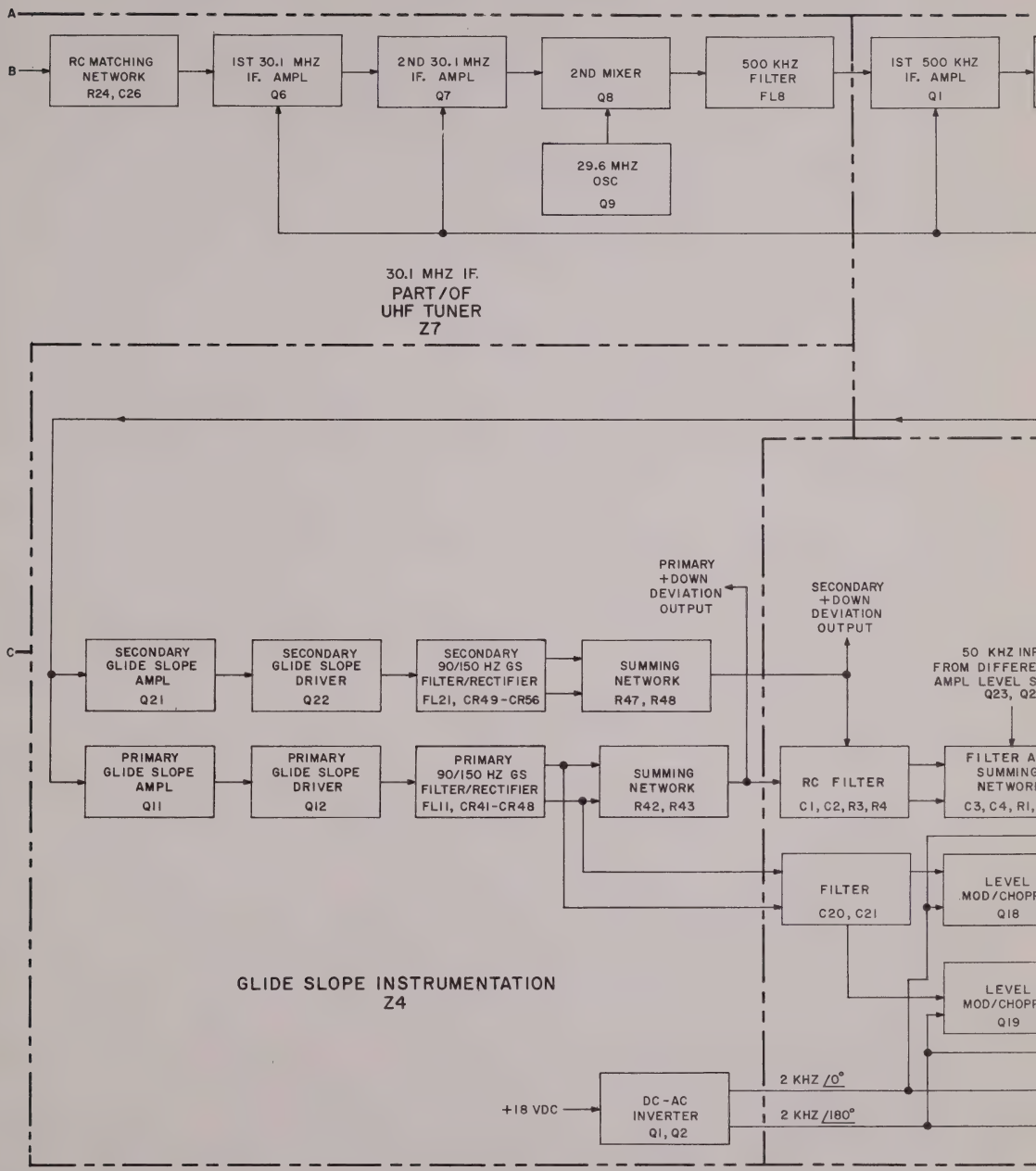

A
B
ENABLE
VDC
GLIDE SLOPE
ANT.
SC
Q4
TEST INJECTION
AMPL
Q5
UHF
SYNTHESIZER
INJECTION
FROM Z12Q4
TRIPLER
Q3
4 POLE
BANDPASS
FILTER
FL3-FL6
GLIDE SLOPE
TEST SIGNAL
INPUT FROM Z2
OF VHF NAV
RECEIVER PLANAR
ASSEMBLY
SELF TEST
CONTROL
Q2
FIRST MIXER
Q1
30.1 MHZ
XTAL FILTER
FL7
30.1 MHZ SELF-TEST OSC/MOD
PART/OF
UHF TUNER
Z7
C
CK
UHF SYN LOCK
INDICATOR
Q3
UHF SYN LOCK
OUTPUT TO
Z12Q5
LOOP RESPONSE
CONTROL
Q9
MPL
TUNING VOLTS TO
Z12Q3
TP0-4862-035



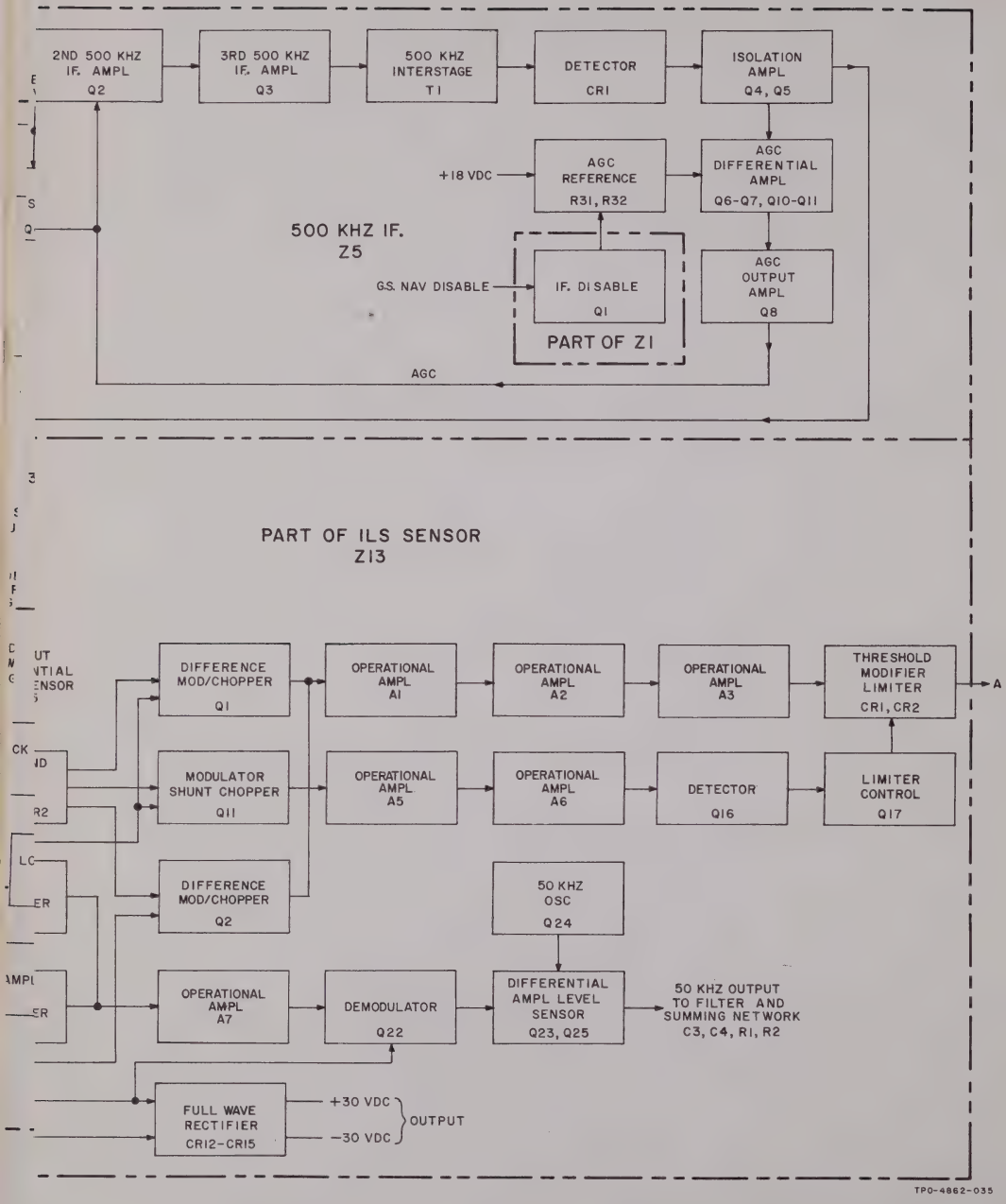
Glideslope Receiver Planar Assembly, Detailed Block Diagram With One Piece UHF Front End Casting (Sheet 2 of 3)
Figure 17



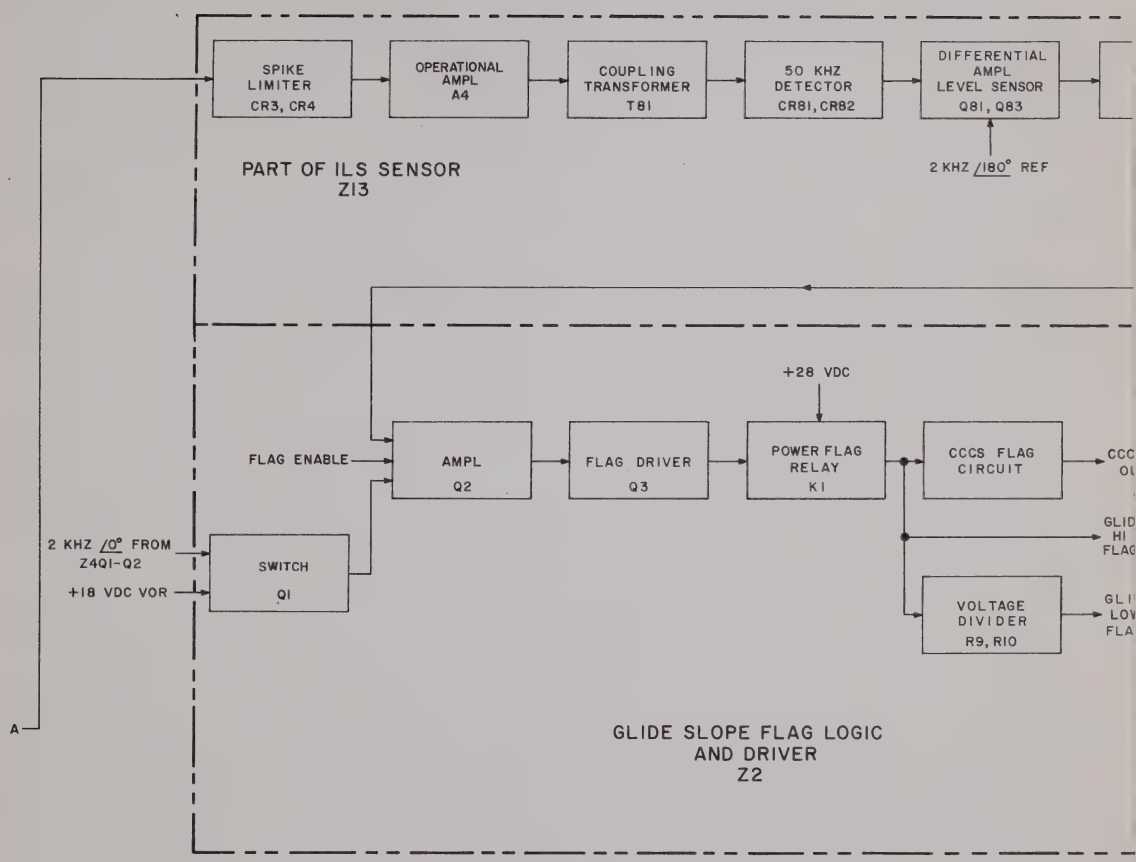
Glideslope Receiver Planar Assembly, Detailed Block Diagram With One Piece UHF Front End Casting (Sheet 1 of 3)
Figure 17


A
B
RC MATCHING NETWORK R24, C26
1ST 30.1 MHZ IF. AMPL Q6
2ND 30.1 MHZ IF. AMPL Q7
2ND MIXER Q8
500 KHZ FILTER FL8
1ST 500 KHZ IF. AMPL Q1
29.6 MHZ OSC Q9
30.1 MHZ IF. PART OF UHF TUNER Z7
C
PRIMARY +DOWN DEVIATION OUTPUT
SECONDARY +DOWN DEVIATION OUTPUT
SECONDARY GLIDE SLOPE AMPL Q21
SECONDARY GLIDE SLOPE DRIVER Q22
SECONDARY 90/150 HZ GS FILTER/RECTIFIER FL21, CR49-CR56
SUMMING NETWORK R47, R48
50 KHZ INP FROM DIFFERE AMPL LEVEL S Q23, Q2
PRIMARY GLIDE SLOPE AMPL Q11
PRIMARY GLIDE SLOPE DRIVER Q12
PRIMARY 90/150 HZ GS FILTER/RECTIFIER FL11, CR41-CR48
SUMMING NETWORK R42, R43
RC FILTER C1, C2, R3, R4
FILTER A SUMMING NETWORK C3, C4, R1,
FILTER C20, C21
LEVEL MOD/CHOPP Q18
LEVEL MOD/CHOPP Q19
GLIDE SLOPE INSTRUMENTATION Z4
+18 VDC
DC-AC INVERTER Q1, Q2
2 KHZ /0°
2 KHZ /180°

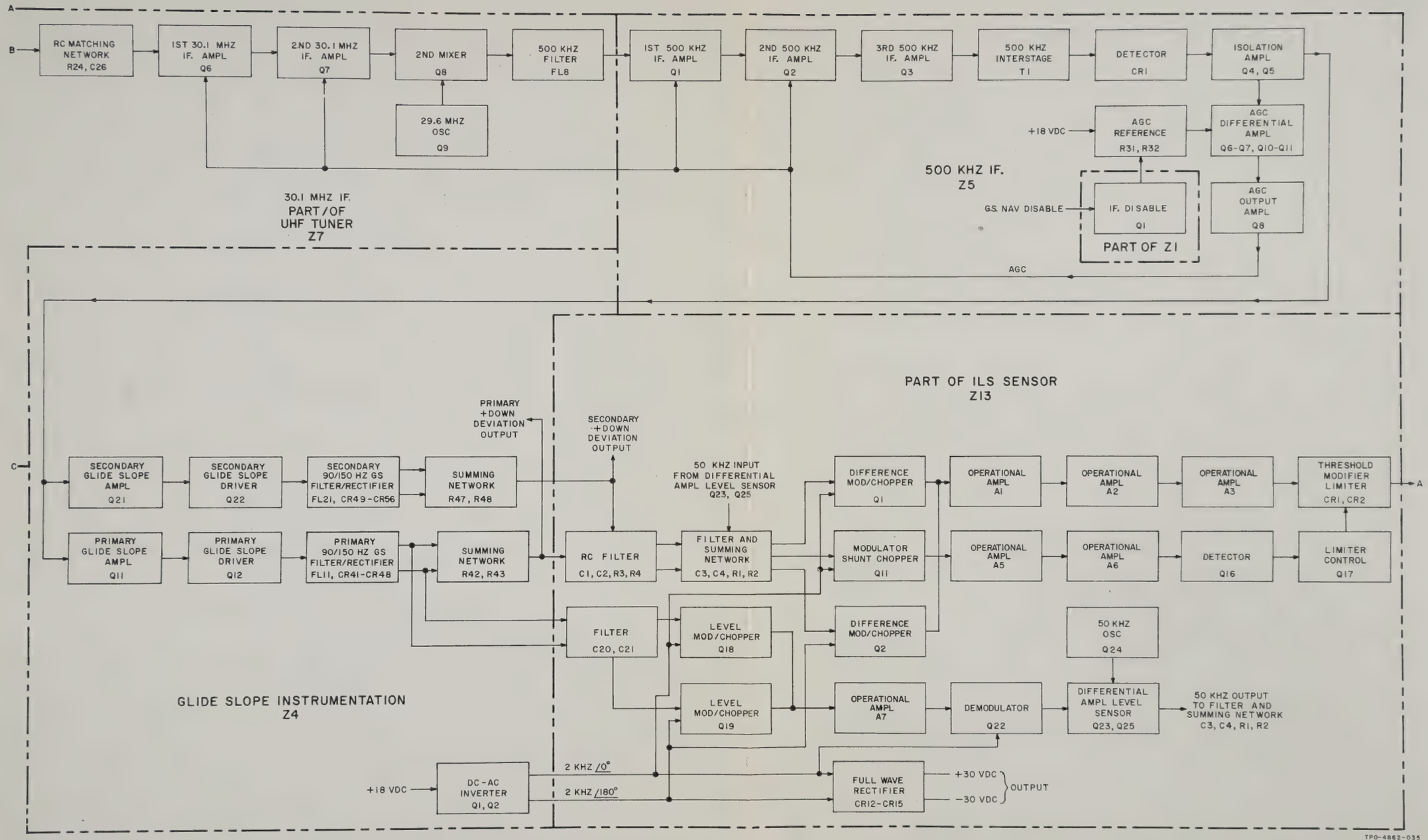
Glideslope Receiver Planar Assembly, Detailed Block Diagram With One Piece UHF Front End Casting (Sheet 2 of 3)
Figure 17


2ND 500 KHZ IF. AMPL Q2
3RD 500 KHZ IF. AMPL Q3
500 KHZ INTERSTAGE T1
DETECTOR CR1
ISOLATION AMPL Q4, Q5
+18 VDC
AGC REFERENCE R31, R32
AGC DIFFERENTIAL AMPL Q6-Q7, Q10-Q11
500 KHZ IF. Z5
G.S. NAV DISABLE
IF. DISABLE Q1
AGC OUTPUT AMPL Q8
PART OF Z1
AGC
PART OF ILS SENSOR Z13
DIFFERENCE MOD/CHOPPER Q1
OPERATIONAL AMPL A1
OPERATIONAL AMPL A2
OPERATIONAL AMPL A3
THRESHOLD MODIFIER LIMITER CR1, CR2
A
MODULATOR SHUNT CHOPPER Q11
OPERATIONAL AMPL A5
OPERATIONAL AMPL A6
DETECTOR Q16
LIMITER CONTROL Q17
DIFFERENCE MOD/CHOPPER Q2
50 KHZ OSC Q24
OPERATIONAL AMPL A7
DEMODULATOR Q22
DIFFERENTIAL AMPL LEVEL SENSOR Q23, Q25
50 KHZ OUTPUT TO FILTER AND SUMMING NETWORK C3, C4, R1, R2
FULL WAVE RECTIFIER CR12-CR15
+30 VDC
-30 VDC
OUTPUT

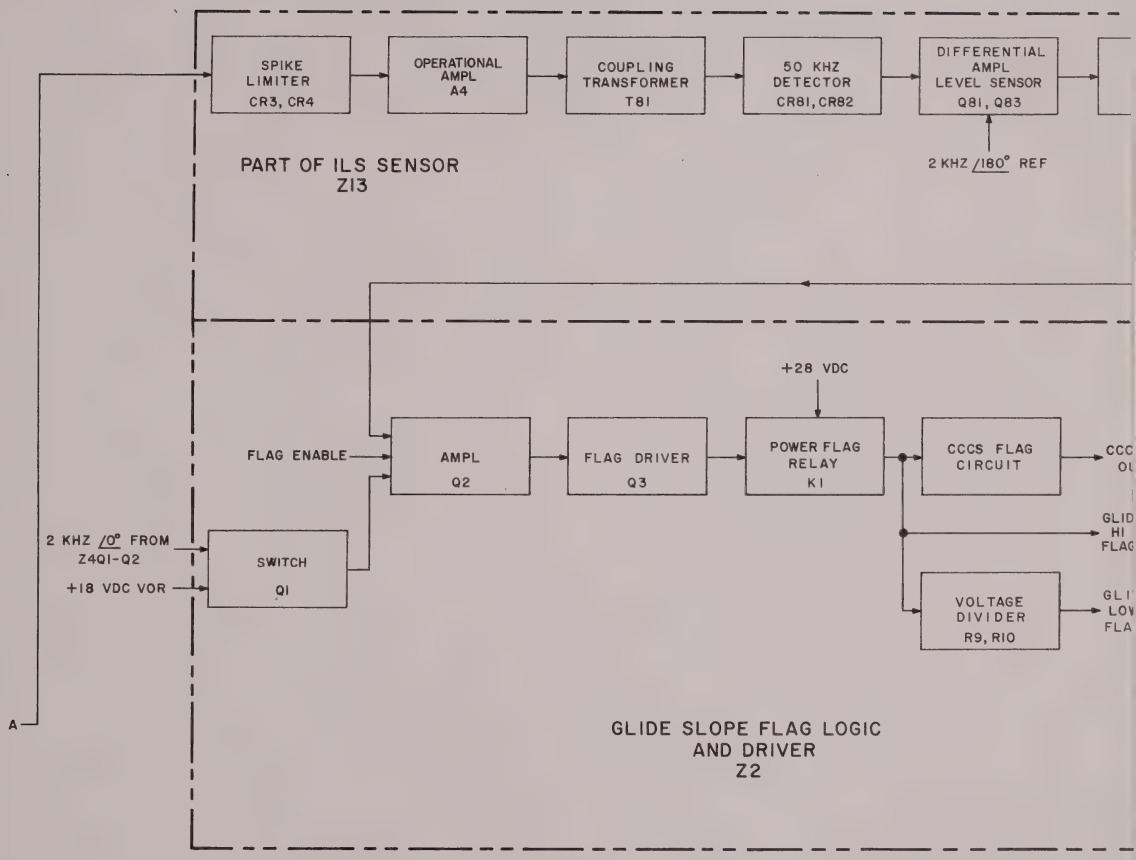
TPO-4862-035



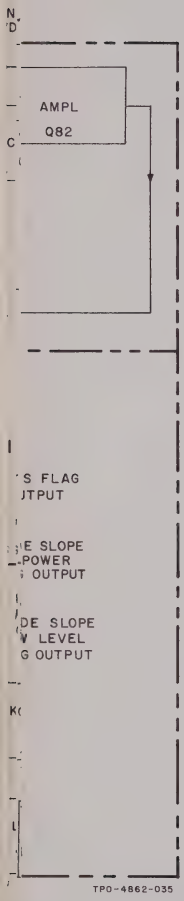
Glideslope Receiver Planar Assembly, Detailed Block Diagram With One Piece UHF Front End Casting (Sheet 3 of 3)
Figure 17


A
B
RC MATCHING NETWORK R24, C26
1ST 30.1 MHZ IF. AMPL Q6
2ND 30.1 MHZ IF. AMPL Q7
2ND MIXER Q8
29.6 MHZ OSC Q9
500 KHZ FILTER FL8
30.1 MHZ IF. PART OF UHF TUNER Z7
1ST 500 KHZ IF. AMPL Q1
2ND 500 KHZ IF. AMPL Q2
3RD 500 KHZ IF. AMPL Q3
500 KHZ INTERSTAGE T1
DETECTOR CR1
ISOLATION AMPL Q4, Q5
+18 VDC
AGC REFERENCE R31, R32
AGC DIFFERENTIAL AMPL Q6-Q7, Q10-Q11
500 KHZ IF. Z5
G.S. NAV DISABLE
IF. DISABLE Q1
PART OF Z1
AGC OUTPUT AMPL Q8
AGC
PART OF ILS SENSOR Z13
C
PRIMARY +DOWN DEVIATION OUTPUT
SECONDARY +DOWN DEVIATION OUTPUT
SECONDARY GLIDE SLOPE AMPL Q21
SECONDARY GLIDE SLOPE DRIVER Q22
SECONDARY 90/150 HZ GS FILTER/RECTIFIER FL21, CR49-CR56
SUMMING NETWORK R47, R48
50 KHZ INPUT FROM DIFFERENTIAL AMPL LEVEL SENSOR Q23, Q25
DIFFERENCE MOD/CHOPPER Q1
OPERATIONAL AMPL A1
OPERATIONAL AMPL A2
OPERATIONAL AMPL A3
THRESHOLD MODIFIER LIMITER CR1, CR2
A
PRIMARY GLIDE SLOPE AMPL Q11
PRIMARY GLIDE SLOPE DRIVER Q12
PRIMARY 90/150 HZ GS FILTER/RECTIFIER FL11, CR41-CR48
SUMMING NETWORK R42, R43
RC FILTER C1, C2, R3, R4
FILTER AND SUMMING NETWORK C3, C4, R1, R2
MODULATOR SHUNT CHOPPER Q11
OPERATIONAL AMPL A5
OPERATIONAL AMPL A6
DETECTOR Q16
LIMITER CONTROL Q17
FILTER C20, C21
LEVEL MOD/CHOPPER Q18
DIFFERENCE MOD/CHOPPER Q2
50 KHZ OSC Q24
GLIDE SLOPE INSTRUMENTATION Z4
LEVEL MOD/CHOPPER Q19
OPERATIONAL AMPL A7
DEMODULATOR Q22
DIFFERENTIAL AMPL LEVEL SENSOR Q23, Q25
50 KHZ OUTPUT TO FILTER AND SUMMING NETWORK C3, C4, R1, R2
+18 VDC
DC-AC INVERTER Q1, Q2
2 KHZ /0°
2 KHZ /180°
FULL WAVE RECTIFIER CR12-CR15
+30 VDC
-30 VDC
OUTPUT
TPO-4862-035

Glideslope Receiver Planar Assembly, Detailed Block Diagram With One Piece UHF Front End Casting (Sheet 2 of 3)
Figure 17



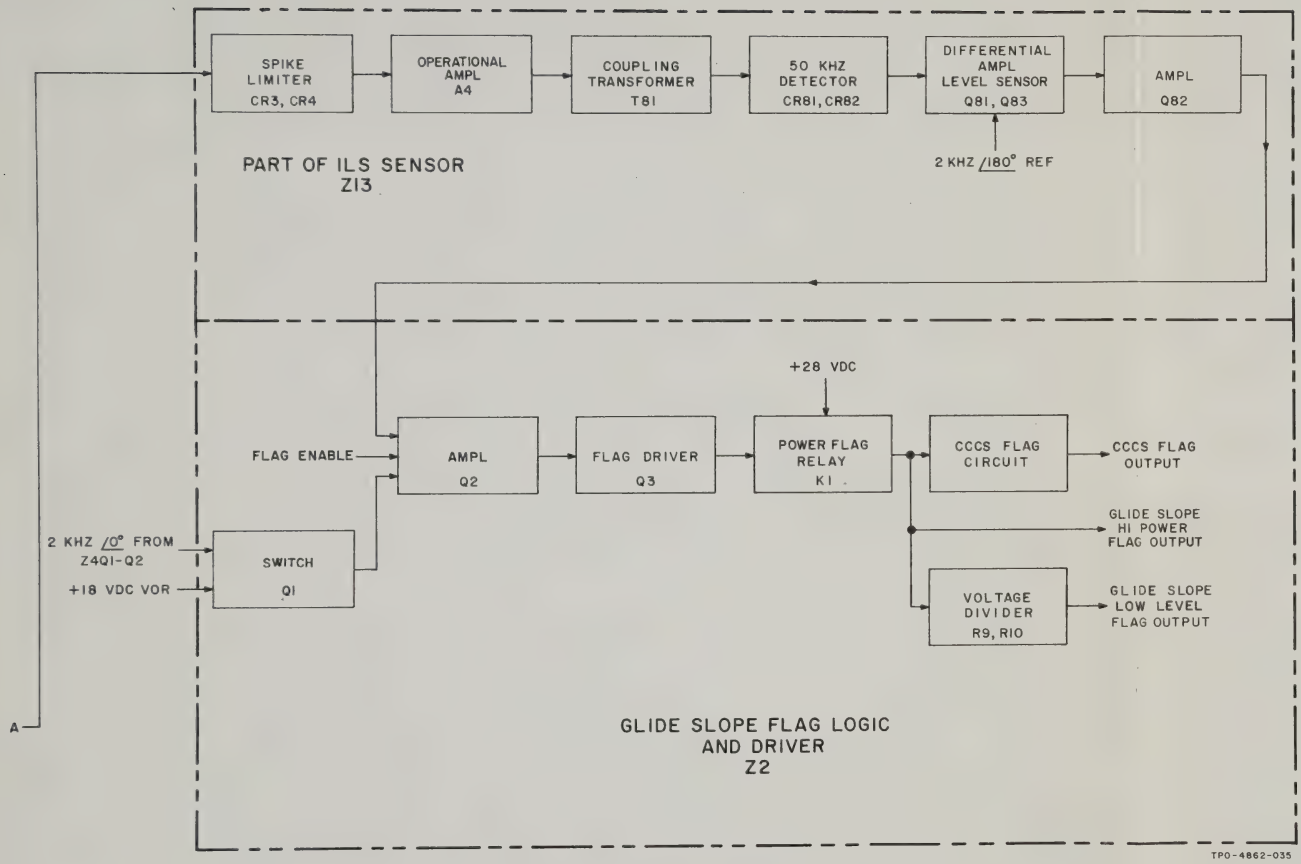
Glideslope Receiver Planar Assembly, Detailed Block Diagram With One Piece UHF Front End Casting (Sheet 3 of 3)
Figure 17


AMPL
Q82
S FLAG
JTPUT
E SLOPE
POWER
OUTPUT
DE SLOPE
LEVEL
G OUTPUT
TP0-4862-035

51RV-2B VOR/ILS Receiver - Troubleshooting

1. GENERAL.

To determine if the 51RV-2B is operating properly, perform the procedures listed in the adjustment/test section of this manual. If the 51RV-2B is not operating properly, replace it with an operational unit.



Glideslope Receiver Planar Assembly, Detailed Block Diagram With One Piece UHF Front End Casting (Sheet 3 of 3)
Figure 17

51RV-2B VOR/ILS Receiver - Troubleshooting

1. GENERAL.

To determine if the 51RV-2B is operating properly, perform the procedures listed in the adjustment/test section of this manual. If the 51RV-2B is not operating properly, replace it with an operational unit.

51RV-2B VOR/ILS Receiver - Maintenance Practices

(Not Applicable)

51RV-2B VOR/ILS Receiver - Servicing

(Not Applicable)

51RV-2B VOR/ILS Receiver - Removal/Installation

1. GENERAL.

This section provides information for initial installation of the 51RV-2B, and for subsequent removal and replacement. The information includes aircraft wiring and installation drawings for the 51RV-2B.

2. INITIAL INSTALLATION.

A. Aircraft Preparation.

(1) Cabling.

The aircraft must be capable of supplying the following primary power to the 51RV-2B VOR/ILS Receiver.

(a) +27.5 volts dc +10 percent -20 percent.

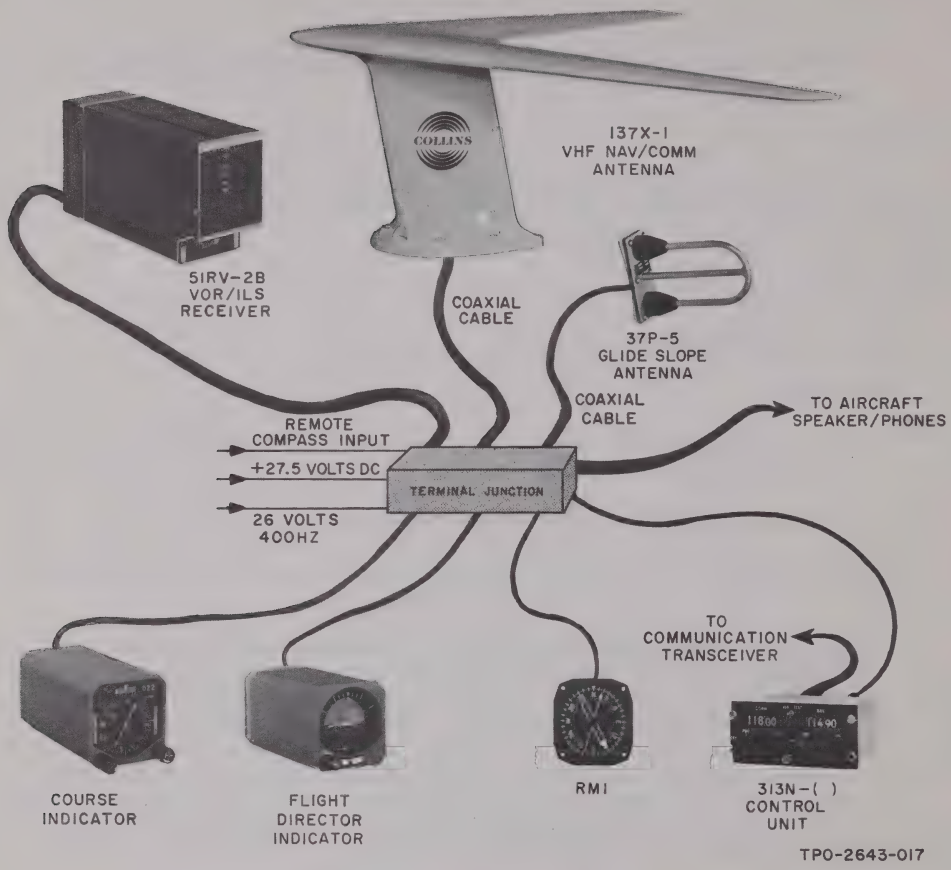
(b) 26 volts ac, 400 ±20 Hz, 16 volt-amperes, plus power requirements of external indicators chosen by user.

A typical 51RV-2B installation cabling diagram is shown in figure 401. The suggested 51RV-2B VOR/ILS Receiver interconnect diagram is shown in sheet 1 of figure 402. All interconnection instructions shown in the notes of sheet 2 of 402 should be followed carefully. Compass no. 1 and compass no. 2 can be connected to a common power source. If each compass has a separate power source, see notes 11 and 12 of figure 402 for proper connections with VOR bearing pointer and compass card synchro motor. If the 3 o'clock (right wing point) bias circuit has been removed, TP15 need not be connected to the power supplying compass no. 1 as shown in figure 402.

When connecting wires, observe the following precautions. Bond and shield all parts of the aircraft electrical system, such as the generators and ignition systems. Keep the connecting cables away from circuits carrying heavy current, equipment transmitting pulses, or other sources of interference.

Make all external connections to the 51RV-2B through the mating connector which is located in the 390Y-1 Shockmount or on an ARINC rack in the aircraft. Figure 403 lists the connectors used. All connection cables can be made with #22 AWG wire unless otherwise noted. The thermoplastic insulated wire is recommended. Leave slack in the wire to allow free sway of the equipment in the 390Y-1 Shockmount and to keep the wire from breaking.

Normally, the shields of the audio wires should be grounded only at one end and to a SPASE ground. For balanced connections, use of twisted-pair shielded wire will result in minimum pickup of electrostatic and magnetic fields. Avoid long runs of wire and keep input and output circuits well separated insofar as practical.



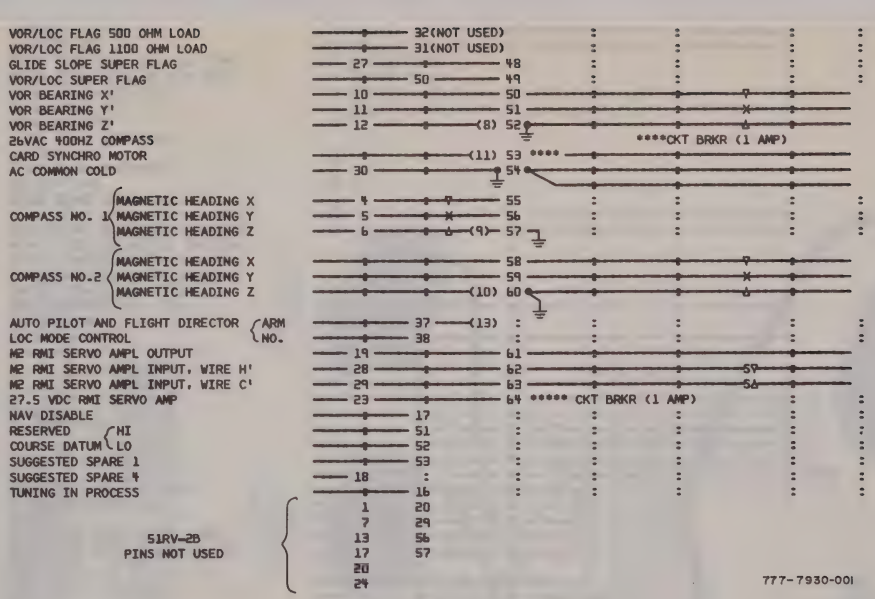
51RV-2B Typical Installation Cabling Diagram
Figure 401

After installation of the cabling and before installation of the equipment, a check should be made with power to the shockmount connectors. Check to be sure that power is applied only to the pins specified by the wiring diagram.

(2) Control Units.

The 51RV-2B is used with the 313N-( ) control unit (313N-( ) designates controls listed in figure 3). For outline and mounting information and frequency range of control units, refer to the applicable instruction book. The list of instruction books may be found in the foreword of this manual.

51RV-2B VOR/ILS Receiver, Suggested Interconnect Diagram (Sheet 1 of 2)
Figure 402


VOR/LOC FLAG 500 OHM LOAD
VOR/LOC FLAG 1100 OHM LOAD
GLIDE SLOPE SUPER FLAG
VOR/LOC SUPER FLAG
VOR BEARING X'
VOR BEARING Y'
VOR BEARING Z'
26VAC 400HZ COMPASS
CARD SYNCHRO MOTOR
AC COMMON COLD
COMPASS NO. 1
MAGNETIC HEADING X
MAGNETIC HEADING Y
MAGNETIC HEADING Z
COMPASS NO.2
MAGNETIC HEADING X
MAGNETIC HEADING Y
MAGNETIC HEADING Z
AUTO PILOT AND FLIGHT DIRECTOR
ARM
LOC MODE CONTROL
NO.
M2 RMI SERVO AMPL OUTPUT
M2 RMI SERVO AMPL INPUT, WIRE H'
M2 RMI SERVO AMPL INPUT, WIRE C'
27.5 VDC RMI SERVO AMP
NAV DISABLE
RESERVED
COURSE DATUM
HI
LO
SUGGESTED SPARE 1
SUGGESTED SPARE 4
TUNING IN PROCESS
51RV-2B
PINS NOT USED
1
7
13
17
20
24
20
29
56
57
32(NOT USED)
31(NOT USED)
27
48
50
49
10
50
11
51
12
(8)
52
****CKT BRKR (1 AMP)
(11)
53
30
54
4
55
5
56
6
(9)
57
58
59
(10)
60
37
(13)
38
19
61
28
62
29
63
23
64
***** CKT BRKR (1 AMP)
17
51
52
53
18
16

777-7930-001

LEGEND:

1. SY REFERS TO SHIELDED TWISTED PAIR. SHIELD IS TO HAVE AN INSULATING JACKET. ALL SHIELDS FOR A GIVEN CIRCUIT ARE SA TO BE GROUNDED AT ONE END ONLY AND TO THE SAME GROUND STUD.

2. Y REFERS TO TRIPLE-TWISTED WIRE, NOT SHIELDED.
   X
   A

NOTES:

(1) ALL WIRE DESIGNATED BY NOTE (1) IS TO BE DOUBLE-SHIELDED COAX.

(2) TP DESIGNATES TOP PLUG AND BP DESIGNATES BOTTOM PLUG.
MAIN CONNECTOR: CANNON DPX2-CA-32W2PS7P-3M3, COLLINS PART NUMBER 370-5233-00.
MATING CONNECTOR: CANNON DPX2-CA-32W2SS7S-33B, COLLINS PART NUMBER 370-5242-00.

(3) TERMINAL BOARD JUNCTION NUMBERS ARE SHOWN FOR REFERENCE ONLY. NO SEQUENTIAL REQUIREMENT IS INTENDED.

(4) CONNECTORS USED FOR TYPICAL 51RV-2B INSTALLATION ARE LISTED IN FIG. 403.

(5) MATING CONNECTOR: TYPE BNC UG-88/U, COLLINS PART NUMBER 357-9252-00. ANTENNA CABLE CONNECTOR LISTED WILL ACCEPT RG-58/U CABLE.

(6) MATING CONNECTOR FOR 37P-*: UG-21B/U, COLLINS PART NUMBER 357-9090-00. MATING CONNECTOR FOR 37P-5: UG-709A/U, COLLINS PART NUMBER 357-9167-00. ANTENNA CABLE CONNECTORS LISTED WILL ACCEPT RG-8/U CABLE.

(7) THE 51RV-2B IS CAPABLE OF DRIVING A MAXIMUM OF FIVE VOR/LOC OR GLIDE SLOPE PARALLEL CONNECTED FLAG LOADS. THE EQUIVALENT FLAG LOAD RESISTANCE MUST BE FROM 200- TO 1000- OHMS.

(8) VOR BEARING DATA SINGLE POINT GROUND.

(9) COMPASS NO. 1 SYNCHRO TRANSMITTER SINGLE POINT GROUND.

(10) COMPASS NO. 2 SYNCHRO TRANSMITTER SINGLE POINT GROUND.

(11) CONNECT TO SAME BUS WHICH SUPPLIES POWER TO COMPASS NO. 2.

(12) CONNECT TO SAME BUS WHICH SUPPLIES POWER TO COMPASS NO. 1.

(13) MAXIMUM CURRENT ALLOWABLE IS 0.5 AMPERE. REFERENCE ARINC 547.

(14) ROTOR H USED ONLY IF SYSTEM IS TO BE INTERCHANGABLE WITH 51RV-1 SYSTEM.

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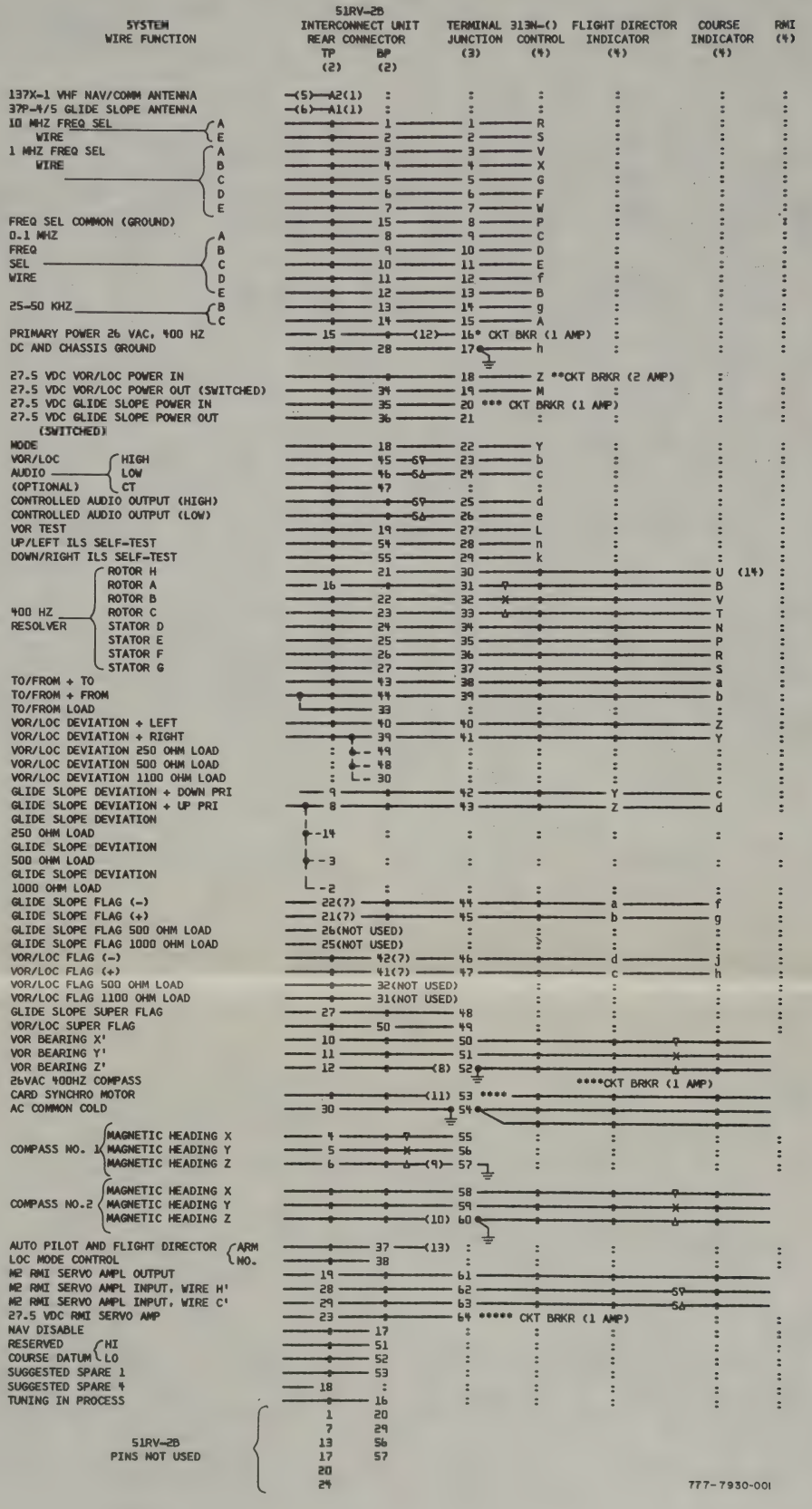
51RV-2B VOR/ILS Receiver, Suggested Interconnect Diagram (Sheet 2 of 2)
Figure 402.

IMPORTANT: READ ALL NOTES CAREFULLY. NUMBERS IN ( ) APPLY TO SPECIFIC NOTES.


SYSTEM WIRE FUNCTION
51RV-2B INTERCONNECT UNIT REAR CONNECTOR TP (2) BP (2)
TERMINAL JUNCTION (3)
313N-() CONTROL (4)
FLIGHT DIRECTOR INDICATOR (4)
COURSE INDICATOR (4)
RMI (4)
137X-1 VHF NAV/COMM ANTENNA
37P-4/5 GLIDE SLOPE ANTENNA
10 MHZ FREQ SEL WIRE
1 MHZ FREQ SEL WIRE
FREQ SEL COMMON (GROUND)
0.1 MHZ FREQ SEL WIRE
25-50 KHZ
PRIMARY POWER 26 VAC, 400 HZ
DC AND CHASSIS GROUND
27.5 VDC VOR/LOC POWER IN
27.5 VDC VOR/LOC POWER OUT (SWITCHED)
27.5 VDC GLIDE SLOPE POWER IN
27.5 VDC GLIDE SLOPE POWER OUT (SWITCHED)
MODE
VOR/LOC AUDIO (OPTIONAL) HIGH LOW CT
CONTROLLED AUDIO OUTPUT (HIGH)
CONTROLLED AUDIO OUTPUT (LOW)
VOR TEST
UP/LEFT ILS SELF-TEST
DOWN/RIGHT ILS SELF-TEST
400 HZ RESOLVER ROTOR H ROTOR A ROTOR B ROTOR C STATOR D STATOR E STATOR F STATOR G
TO/FROM + TO
TO/FROM + FROM
TO/FROM LOAD
VOR/LOC DEVIATION + LEFT
VOR/LOC DEVIATION + RIGHT
VOR/LOC DEVIATION 250 OHM LOAD
VOR/LOC DEVIATION 500 OHM LOAD
VOR/LOC DEVIATION 1100 OHM LOAD
GLIDE SLOPE DEVIATION + DOWN PRI
GLIDE SLOPE DEVIATION + UP PRI
GLIDE SLOPE DEVIATION 250 OHM LOAD
GLIDE SLOPE DEVIATION 500 OHM LOAD
GLIDE SLOPE DEVIATION 1000 OHM LOAD
GLIDE SLOPE FLAG (-)
GLIDE SLOPE FLAG (+)
GLIDE SLOPE FLAG 500 OHM LOAD
GLIDE SLOPE FLAG 1000 OHM LOAD
VOR/LOC FLAG (-)
VOR/LOC FLAG (+)
VOR/LOC FLAG 500 OHM LOAD
VOR/LOC FLAG 1100 OHM LOAD
GLIDE SLOPE SUPER FLAG
VOR/LOC SUPER FLAG
VOR BEARING X'
VOR BEARING Y'
VOR BEARING Z'
26VAC 400HZ COMPASS
CARD SYNCHRO MOTOR
AC COMMON COLD
COMPASS NO. 1 MAGNETIC HEADING X MAGNETIC HEADING Y MAGNETIC HEADING Z
COMPASS NO.2 MAGNETIC HEADING X MAGNETIC HEADING Y MAGNETIC HEADING Z
AUTO PILOT AND FLIGHT DIRECTOR ARM
LOC MODE CONTROL NO.
M2 RMI SERVO AMPL OUTPUT
M2 RMI SERVO AMPL INPUT, WIRE H'
M2 RMI SERVO AMPL INPUT, WIRE C'
27.5 VDC RMI SERVO AMP
NAV DISABLE
RESERVED
COURSE DATUM HI LO
SUGGESTED SPARE 1
SUGGESTED SPARE 4
TUNING IN PROCESS
51RV-2B PINS NOT USED
16° CKT BKR (1 AMP)
**CKT BRKR (2 AMP)
*** CKT BRKR (1 AMP)
****CKT BRKR (1 AMP)
***** CKT BRKR (1 AMP)
777-7930-001

51RV-2B VOR/ILS Receiver, Suggested Interconnect Diagram (Sheet 1 of 2)
Figure 402

LEGEND:

1. SY REFERS TO SHIELDED TWISTED PAIR. SHIELD IS TO HAVE AN INSULATING JACKET. ALL SHIELDS FOR A GIVEN CIRCUIT ARE SA TO BE GROUNDED AT ONE END ONLY AND TO THE SAME GROUND STUD.

2. V
   X REFERS TO TRIPLE-TWISTED WIRE, NOT SHIELDED.
   &

NOTES:

(1) ALL WIRE DESIGNATED BY NOTE (1) IS TO BE DOUBLE-SHIELDED COAX.

(2) TP DESIGNATES TOP PLUG AND BP DESIGNATES BOTTOM PLUG.
MAIN CONNECTOR: CANNON DPX2-CA-32W2PS7P-3N0, COLLINS PART NUMBER 370-5233-00.
MATING CONNECTOR: CANNON DPX2-CA-32W2S57S-33B, COLLINS PART NUMBER 370-5242-00.

(3) TERMINAL BOARD JUNCTION NUMBERS ARE SHOWN FOR REFERENCE ONLY. NO SEQUENTIAL REQUIREMENT IS INTENDED.

(4) CONNECTORS USED FOR TYPICAL 51RV-2B INSTALLATION ARE LISTED IN FIG. 403.

(5) MATING CONNECTOR: TYPE BNC UG-88/U, COLLINS PART NUMBER 357-9292-00. ANTENNA CABLE CONNECTOR LISTED WILL ACCEPT RG-58/U CABLE.

(6) MATING CONNECTOR FOR 37P-4: UG-21B/U, COLLINS PART NUMBER 357-8040-00. MATING CONNECTOR FOR 37P-5: UG-70A/U, COLLINS PART NUMBER 357-9167-00. ANTENNA CABLE CONNECTORS LISTED WILL ACCEPT RG-8/U CABLE.

(7) THE 51RV-2B IS CAPABLE OF DRIVING A MAXIMUM OF FIVE VOR/LOC OR GLIDE SLOPE PARALLEL CONNECTED FLAG LOADS. THE EQUIVALENT FLAG LOAD RESISTANCE MUST BE FROM 200- TO 1000- OHMS.

(8) VOR BEARING DATA SINGLE POINT GROUND.

(9) COMPASS NO. 1 SYNCHRO TRANSMITTER SINGLE POINT GROUND.

(10) COMPASS NO. 2 SYNCHRO TRANSMITTER SINGLE POINT GROUND.

(11) CONNECT TO SAME BUS WHICH SUPPLIES POWER TO COMPASS NO. 2.

(12) CONNECT TO SAME BUS WHICH SUPPLIES POWER TO COMPASS NO. 1.

(13) MAXIMUM CURRENT ALLOWABLE IS 0.5 AMPERE. REFERENCE ARINC 547.

(14) ROTOR H USED ONLY IF SYSTEM IS TO BE INTERCHANGABLE WITH 51RV-1 SYSTEM.

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51RV-2B VOR/ILS Receiver, Suggested Interconnect Diagram (Sheet 2 of 2)
Figure 402.

Figure 402.

EQUIPMENT	EQUIPMENT CONNECTOR		MATING CONNECTOR		CABLE CLAMP
	DESIGNATION	TYPE	TYPE	COLLINS PART NUMBER	
51RV-2B	51RV-2B rear connector P3	DPX2-CA-32W2P 57P-34B	DPX2-CA-32W2S 57S-33B	370-5229-00	None required
		Cannon coaxial inserts 249-1384-000	Cannon coaxial inserts 249-1390-000	370-5224-00	None required
RMI	Rear connector	AN3102-22-14P	AN3106-22-14S	357-4034-00	None required
NOTE: Proper connectors for the 313N-( ) control, flight director indicator, and course indicator are presented in the applicable instruction book for the series of instrument used. The list of instruction books may be found in the foreword of this manual.					

Connectors Used for Typical 51RV-2B Installation
Figure 403

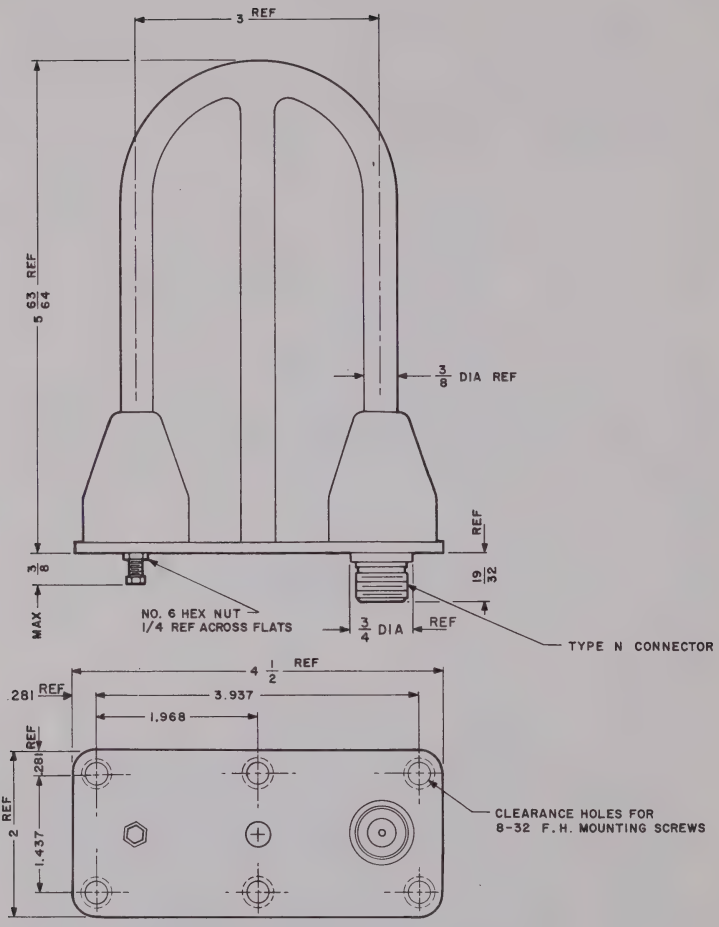
(3) Antennas.

(a) 37P-4/5 Glideslope Antenna.

The 37P-4/5 Glideslope Antenna is recommended for use with the glideslope receiver of the 51RV-2B. The 37P-4 Glideslope Antenna provides one rf connector and is used in a single 51RV-2B installation. The 37P-5 Glideslope Antenna provides two rf connectors and is used in dual installation of the 51RV-2B.

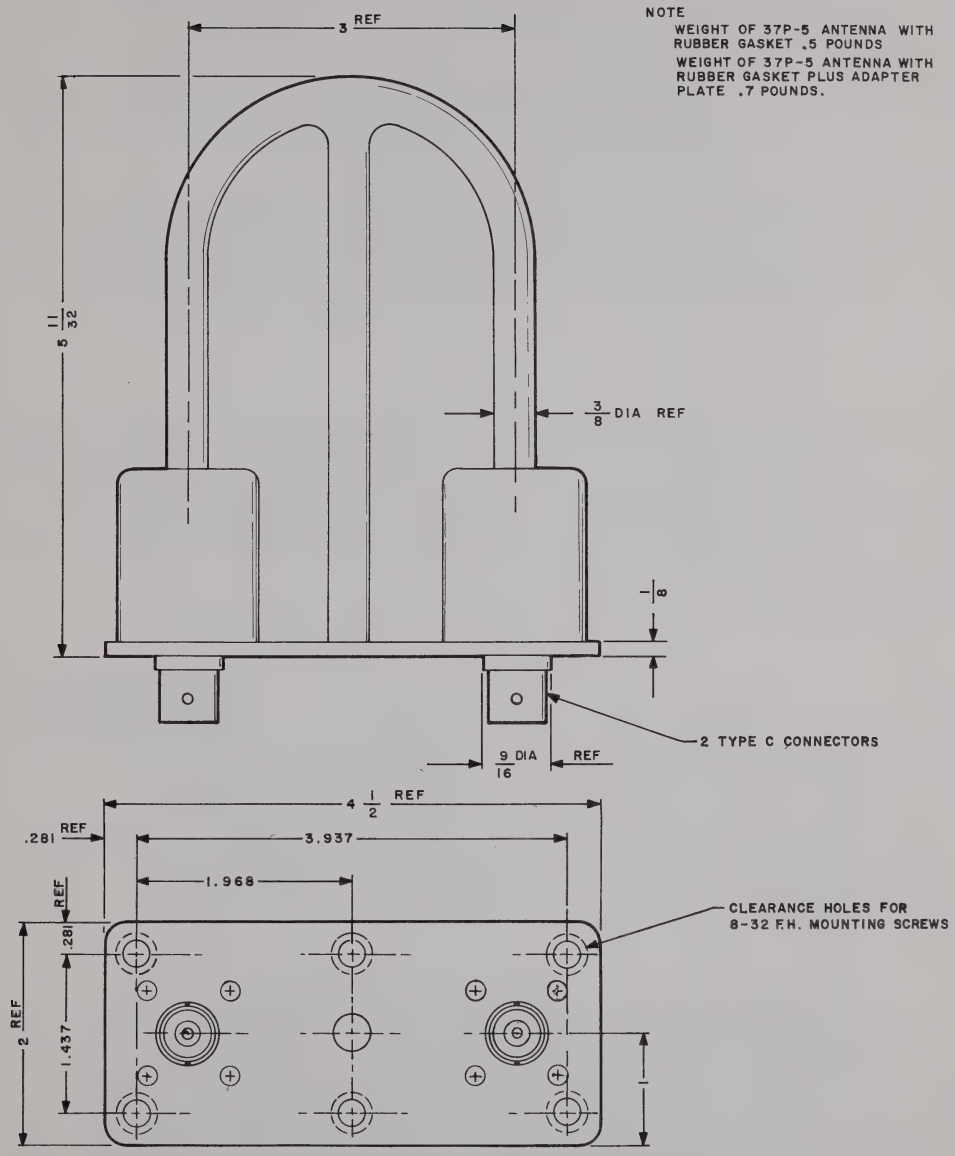
NOTE: Two 37P-4 Glideslope Antennas can also be used for dual 51RV-2B installations, or satisfactory performance can be obtained by using a single 37P-4. In such installations using a single 37P-4, connect the lead from the antenna to a coaxial T-fitting located near the two receivers. Connect each receiver to the T-fitting with cables that are multiples of 12 inches (each side of the T) in length. This cable length is critical, and must be no longer than required.

Refer to figures 404 and 405 for installation information on the glideslope antennas. The selected antenna should be mounted horizontally (within 30 degrees) at the nose of the aircraft. On turbine powered aircraft, the glideslope antenna should be mounted in the unpressurized area on the front



WEIGHT OF 37P-4 ANTENNA WITH RUBBER GASKET. — .5 POUNDS
WEIGHT OF 37P-4 ANTENNA WITH RUBBER GASKET
PLUS ADAPTER PLATE. — .7 POUNDS

37P-4 Glideslope Antenna, Outline and Mounting Dimensions
Figure 404



37P-5 Glideslope Antenna, Outline and Mounting Dimensions
Figure 405

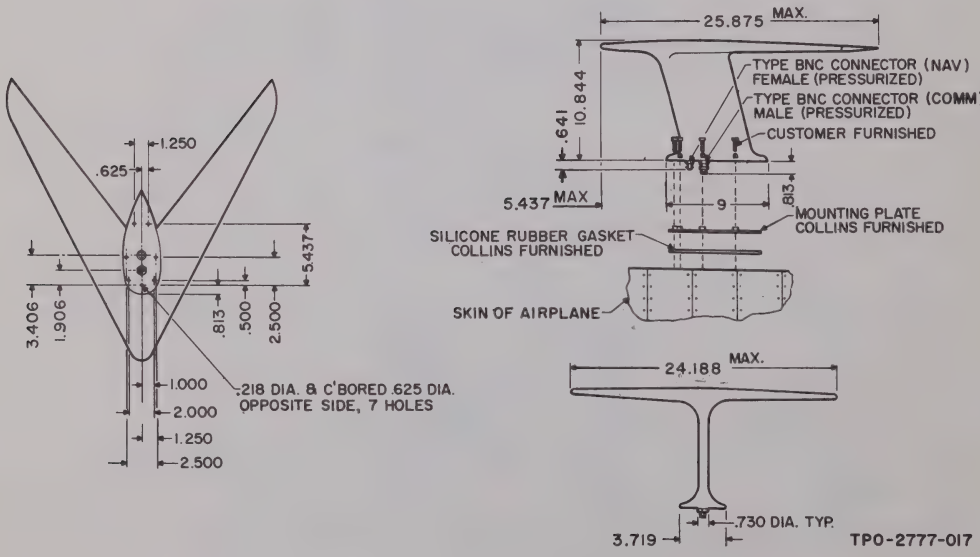
bulkhead inside the radome (mounted below the weather radar antenna). On conventional powered aircraft, the glideslope antenna should be externally mounted on the nose of the aircraft with the antenna connector(s) protruding through the skin of the aircraft.

NOTE: The location of the glideslope antenna (external or internal) for either type of aircraft is to be determined by the user. Antenna performance will not be affected by either external or internal mounting on either type of aircraft.

The 37P-4 has a type-N UG-58/U receptacle and requires the use of the BNC-to-N adapter listed in figure 3. RG-58/U coaxial cable should be used between the adapter and the 51RV-2B connector. This transmission line should be kept as short as possible. Any bends in the cable should have at least a 3-inch radius. The 37P-5 has two type-C connectors.

(b) 137X-1 VHF NAV/COMM Antenna.

The 137X-1 VHF NAV/COMM Antenna is one antenna recommended for use with the VOR/LOC receiver of the 51RV-2B. Outline and mounting dimensions for the 137X-1 are shown in figure 406. Mount the antenna to the aircraft with the special mounting kit (Collins part number 544-4339-00) when the antenna is to be mounted in the same holes drilled for the 37J-3 VHF Navigation Antenna (removed). Mount the antenna to the aircraft with



137X-1 VHF Navigation-Communication Antenna, Outline and Mounting Dimensions
Figure 406

the standard mounting kit (Collins part number 544-4338-00) when new holes are to be drilled. Each mounting kit contains the required mounting gasket and mounting plate. Secure the mounting plate for special mounting with seven AN3 bolts. Secure the 137X-1 VHF NAV/COMM Antenna with six AN3-5 bolts and lockwashers. The standard mounting kit requires six AN3-5 bolts to secure the antenna and mounting plate. RG-58/U coaxial cable should be used between the 137X-1 antenna and the 51RV-2B connector. The transmission line should be kept as short as possible. Any bends in the cable should have at least a 3-inch radius. In dual 51RV-2B installations, connect the lead from the antenna to a T-fitting near the receivers, and connect each receiver to the T-fitting. The two cables between the T-fitting and the receivers should each be 35 inches or a multiple of 35 inches, but it is not necessary that they are both the same length. This cable length is critical and should be kept at 35 inches if possible.

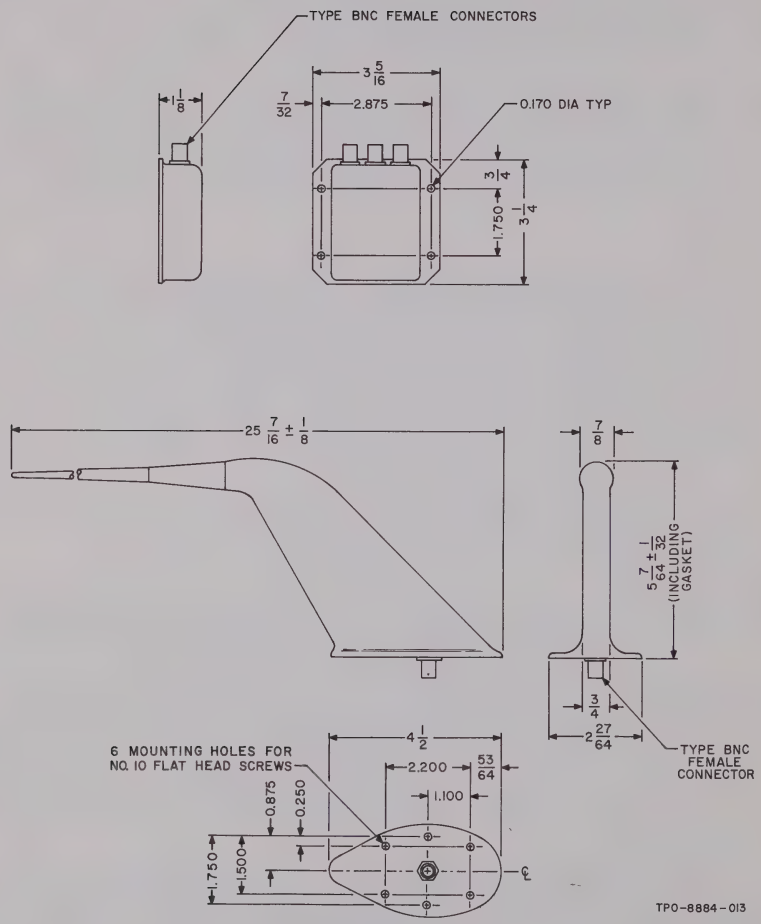
(c) 837B-1 VOR/LOC Antenna.

The 837B-1 VOR/LOC Antenna is also recommended for use with the vhf NAV receiver of the 51RV-2B. Outline and mounting dimensions for the 837B-1 are shown in figure 407. The 837B-1 should be mounted horizontally on the vertical stabilizer (one element on each side) of the aircraft. The hybrid coupler (part of the 837B-1) is mounted inside the vertical stabilizer. Mount the 837B-1 as high as possible on the vertical stabilizer. On T-tail aircraft, the 837B-1 should be mounted at a distance halfway between the top of the fuselage and the bottom of the T-tail. Maximum separation between the two elements is 12 inches (using the cables supplied with the 837B-1). The required mounting gaskets are furnished with the 837B-1. Mounting hardware is to be supplied by the user.

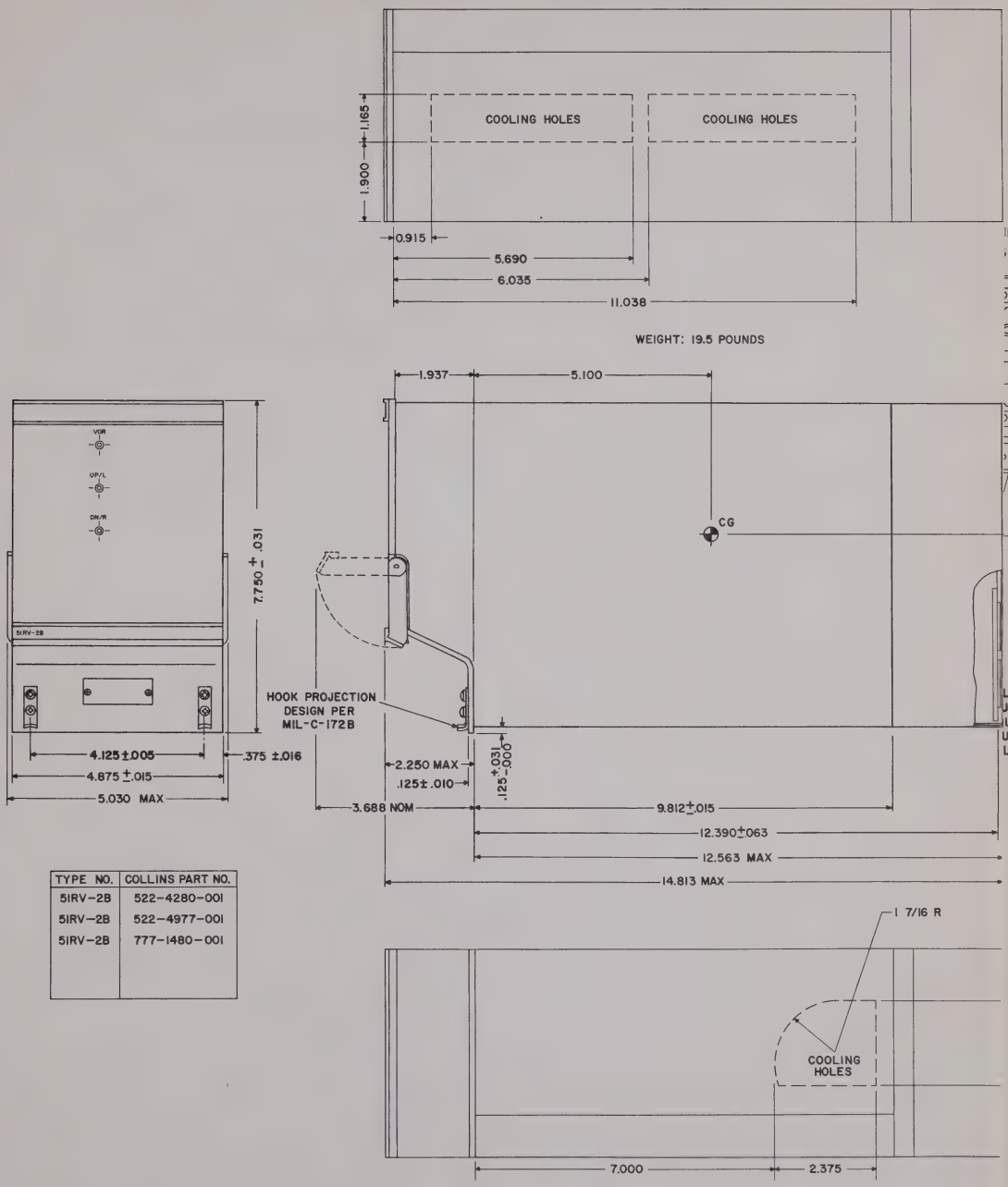
A single female BNC connector on the antenna hybrid is connected to the 51RV-2B by coaxial cable (RG-58/U). This cable run should be kept as short as possible. Any bends in the cable should have at least a 3-inch radius. In dual 51RV-2B installations, connect the lead from the hybrid to a T-fitting near the receivers, and connect each receiver to the T-fitting. The two cables between the T-fitting and the receivers should each be 35 inches or a multiple of 35 inches, but it is not necessary that both cables be the same length. However, the cable length between the T-fitting and the receivers is critical, and should be kept at 35 inches if possible.

(4) 51RV-2B.

Outline dimensions for the 51RV-2B are shown in figure 408. The 51RV-2B is designed to be secured in a shockmount that provides a fastening device and a mating connector. The 390Y-1 Shockmount is a standard 1/2-ATR short shockmount that provides mounting and connector facilities for the 51RV-2B. The vibration isolators may be removed for rigid mounting. Outline and mounting dimensions for the 390Y-1 Shockmount are shown in figure 409. Permanently attach the 390Y-1 to a flat, rigid surface in the aircraft. If the 390Y-1 with vibration isolators is used, ensure that all four grounding straps are bolted to the aircraft structure and permit free movement of the floating part of the shockmount. Allow sufficient clearance on the top and all sides to allow for sway and to facilitate installation and removal of the 51RV-2B.

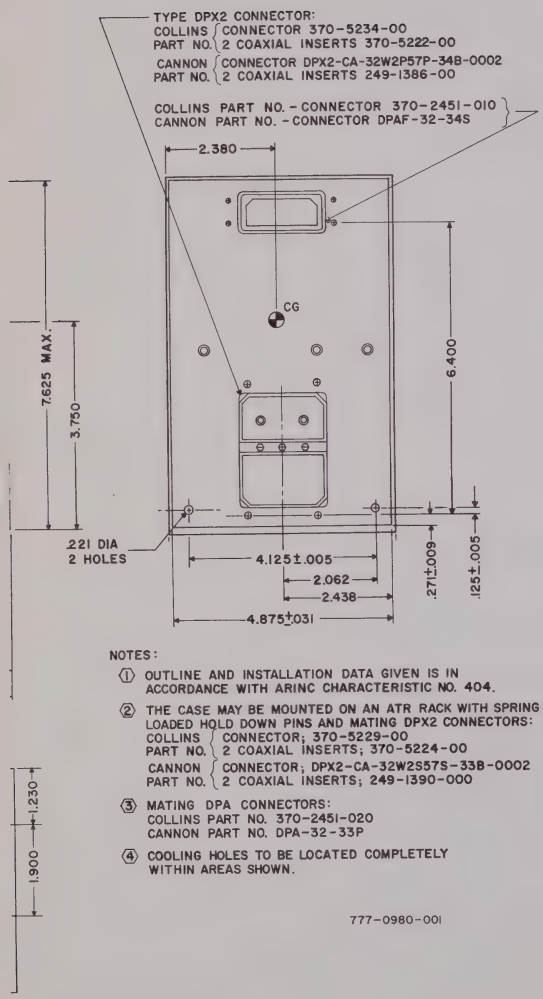


837B-1 VOR/LOC Antenna, Outline and Mounting Dimensions
Figure 407



TYPE NO.	COLLINS PART NO.
5IRV-2B	522-4280-001
5IRV-2B	522-4977-001
5IRV-2B	777-1480-001

51RV-2B VOR/ILS Receiver, Outline and Mounting Dimensions
Figure 408



NOTES:

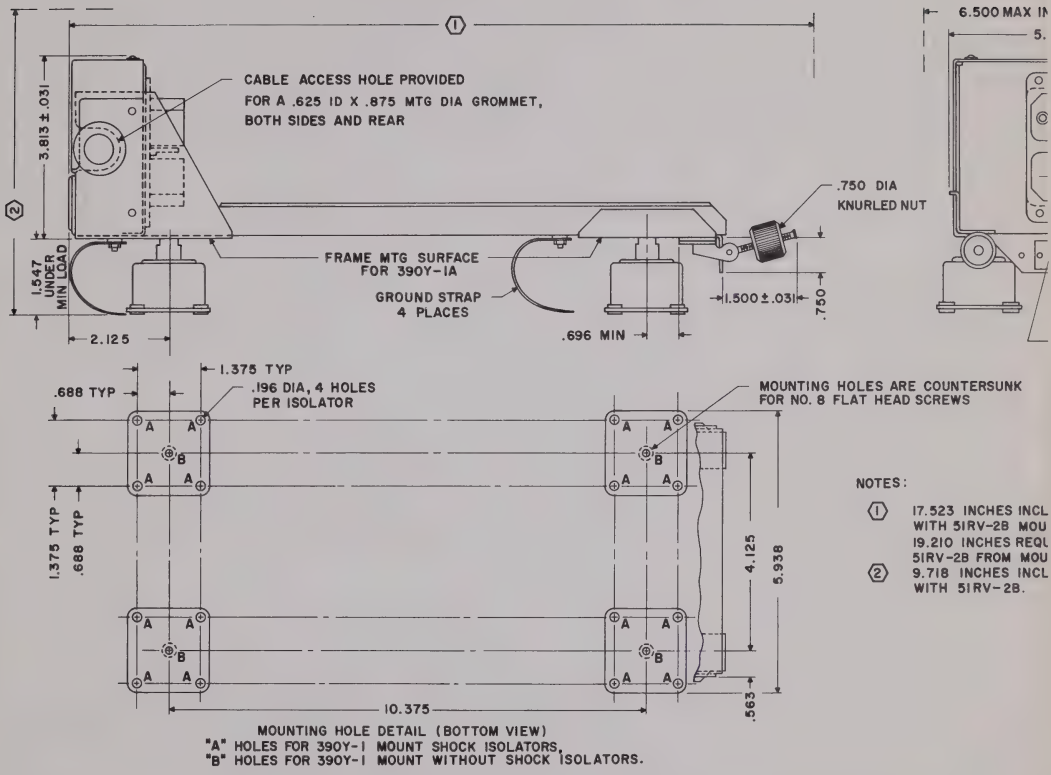
① OUTLINE AND INSTALLATION DATA GIVEN IS IN ACCORDANCE WITH ARINC CHARACTERISTIC NO. 404.

② THE CASE MAY BE MOUNTED ON AN ATR RACK WITH SPRING LOADED HOLD DOWN PINS AND MATING DPX2 CONNECTORS:
COLLINS PART NO. { CONNECTOR; 370-5229-00 / 2 COAXIAL INSERTS; 370-5224-00
CANNON PART NO. { CONNECTOR; DPX2-CA-32W2S57S-33B-0002 / 2 COAXIAL INSERTS; 249-1390-000

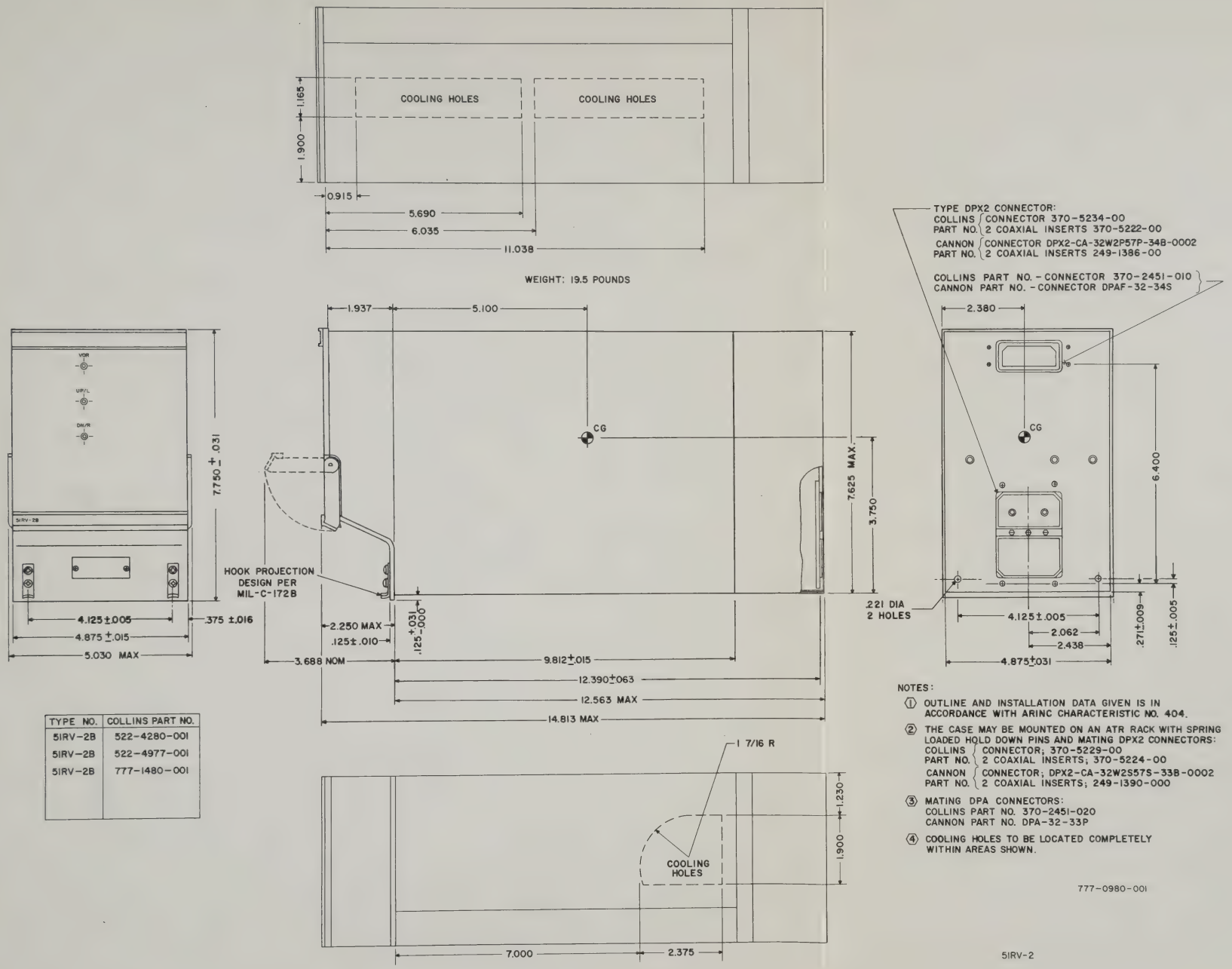
③ MATING DPA CONNECTORS:
COLLINS PART NO. 370-2451-020
CANNON PART NO. DPA-32-33P

④ COOLING HOLES TO BE LOCATED COMPLETELY WITHIN AREAS SHOWN.

777-0980-001



390Y-1 Shockmount, Outline and Mounting Dimensions
Figure 409



TYPE NO.	COLLINS PART NO.
51RV-2B	522-4280-001
51RV-2B	522-4977-001
51RV-2B	777-1480-001

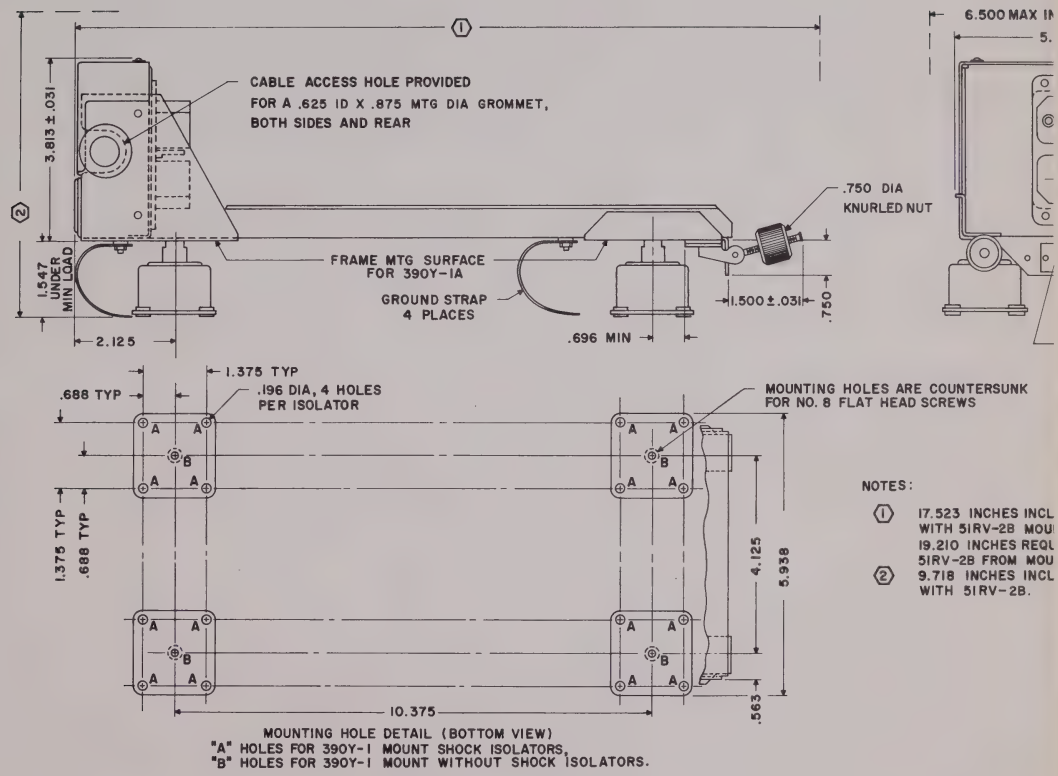
NOTES:

1. OUTLINE AND INSTALLATION DATA GIVEN IS IN ACCORDANCE WITH ARINC CHARACTERISTIC NO. 404.
2. THE CASE MAY BE MOUNTED ON AN ATR RACK WITH SPRING LOADED HOLD DOWN PINS AND MATING DPX2 CONNECTORS:
   COLLINS PART NO. { CONNECTOR; 370-5229-00 / 2 COAXIAL INSERTS; 370-5224-00
   CANNON PART NO. { CONNECTOR; DPX2-CA-32W2S57S-33B-0002 / 2 COAXIAL INSERTS; 249-1390-000
3. MATING DPA CONNECTORS:
   COLLINS PART NO. 370-2451-020
   CANNON PART NO. DPA-32-33P
4. COOLING HOLES TO BE LOCATED COMPLETELY WITHIN AREAS SHOWN.

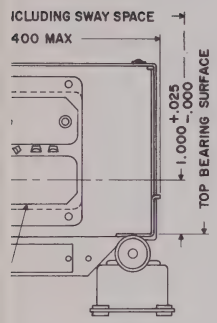
777-0980-001

51RV-2

51RV-2B VOR/ILS Receiver, Outline and Mounting Dimensions
Figure 408



390Y-1 Shockmount, Outline and Mounting Dimensions
Figure 409



REAR CONNECTOR TYPE
DPX2-CA-32W2S57S-33B- 0002
(COLLINS PART NUMBER 370-5229-00)
TWO COAXIAL INSERTS
CANNON NUMBER 249-1390-00
(COLLINS PART NUMBER 370-5224-00)

UDING SWAY SPACE
NTED.
IIRED FOR EXTRACTING
NT.
UDING SWAY SPACE

TPO-2656-015

After all wiring to the shockmount connector is complete (the connector may be removed from the shockmount for wiring), secure the 51RV-2B to the shockmount by tightening and safety wiring thumb nuts over the 51RV-2B projection hooks.

CAUTION: BE SURE THAT THE EQUIPMENT HOUSING AND MOUNT ARE BONDED ELECTRICALLY TO THE AIRFRAME.

B. Equipment Preparation.

(1) Mechanical Check.

Unpack the equipment carefully and inspect for possible shipping damage. All claims for damage in shipment should be filed promptly with the transportation company involved. If claims for damage are to be filed, save the original packing cases and materials.

As shipped from the factory, the 51RV-2B is ready for installation in the aircraft. Check the three screws holding the interconnect unit to the 51RV-2B planar assemblies to ensure a good connection between the interconnect unit and the planar assemblies.

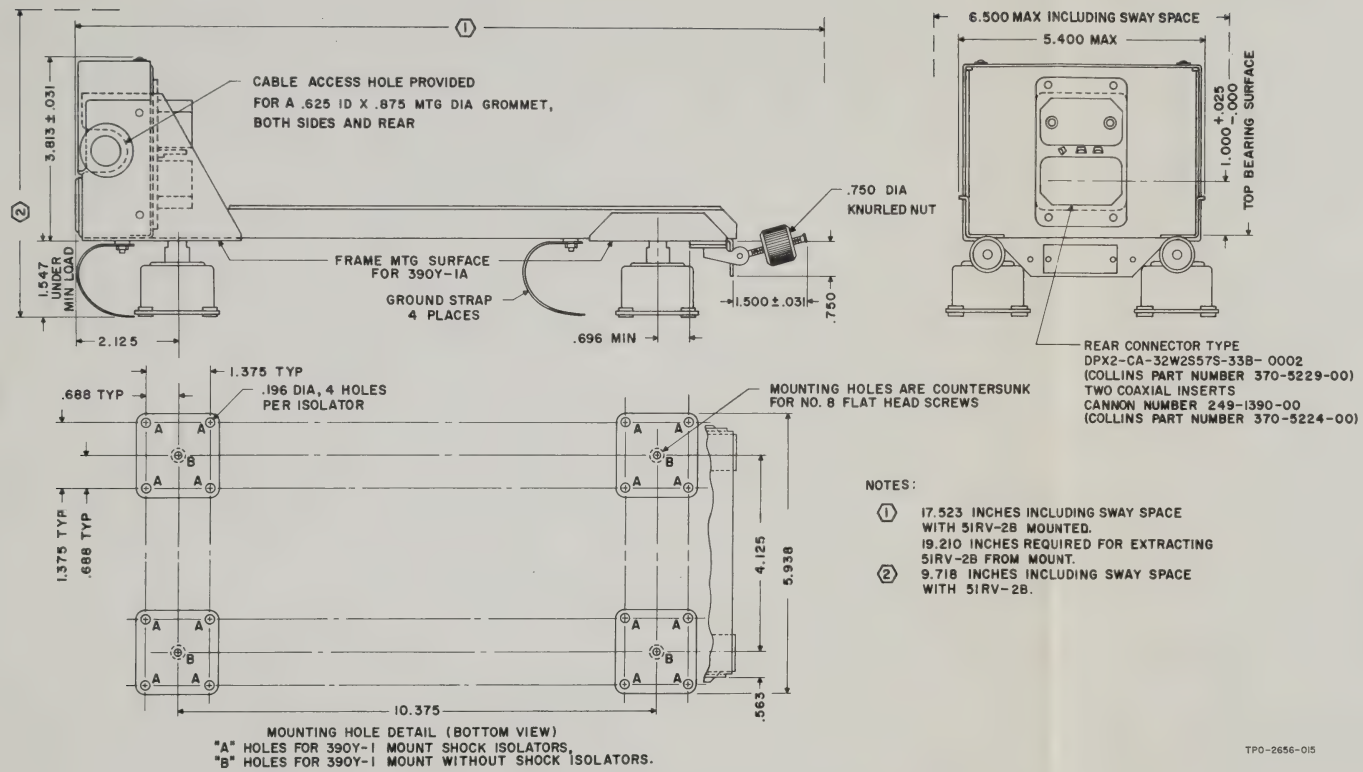
CAUTION: CAREFULLY TEST THE THREE SCREWS TO SEE THAT THEY ARE SNUG. DO NOT ROTATE ANY ONE SCREW MORE THAN ONE TURN WITHOUT APPLYING AN EQUAL TURN TO EACH OF THE OTHER TWO SCREWS. TIGHTEN THE SCREWS UNTIL SNUG, ALWAYS FOLLOWING THE SEQUENCE OF ROTATING ALL THREE SCREWS A TURN AT A TIME.

(2) Wiring Options.

The 51RV-2B VOR/ILS Receiver is equipped with bias circuits that will provide a full UP indication of the glideslope pointer and retract the glideslope flag when a VOR frequency is selected. The bias system is designed to work with the various 329B-( ) flight director indicators and approach horizons and the various 331A-( ) course indicators. The bias circuit can be removed if desired. Because the glideslope receiver must be partially disassembled to remove the bias circuit, the procedures are contained in the testing section of the 951A-1 Glideslope Receiver Planar Assembly Overhaul Manual.

The 51RV-2B also contains a bias system that automatically positions the RMI pointer to a position corresponding to the 3 o'clock position (right wing) of the aircraft when the 51RV-2B is tuned to a localizer frequency. This bias circuit can also be removed if desired. Partial disassembly of the VOR/LOC instrumentation is required in order to remove the right wing bias system. Procedures for removing the bias system are contained in the testing section of the 844A-1 VOR/LOC Instrumentation Planar Assembly Overhaul Manual.

Several wiring options can be accomplished on the self-test generator and timer module. These options provide for changing the flag in-view or flag out-of-view during self-test, and disabling the 3-second timer. Again, partial disassembly of the vhf NAV receiver is required in order to accomplish the wiring options.



390Y-1 Shockmount, Outline and Mounting Dimensions
Figure 409

After all wiring to the shockmount connector is complete (the connector may be removed from the shockmount for wiring), secure the 51RV-2B to the shockmount by tightening and safety wiring thumb nuts over the 51RV-2B projection hooks.

CAUTION: BE SURE THAT THE EQUIPMENT HOUSING AND MOUNT ARE BONDED ELECTRICALLY TO THE AIRFRAME.

B. Equipment Preparation.

(1) Mechanical Check.

Unpack the equipment carefully and inspect for possible shipping damage. All claims for damage in shipment should be filed promptly with the transportation company involved. If claims for damage are to be filed, save the original packing cases and materials.

As shipped from the factory, the 51RV-2B is ready for installation in the aircraft. Check the three screws holding the interconnect unit to the 51RV-2B planar assemblies to ensure a good connection between the interconnect unit and the planar assemblies.

CAUTION: CAREFULLY TEST THE THREE SCREWS TO SEE THAT THEY ARE SNUG. DO NOT ROTATE ANY ONE SCREW MORE THAN ONE TURN WITHOUT APPLYING AN EQUAL TURN TO EACH OF THE OTHER TWO SCREWS. TIGHTEN THE SCREWS UNTIL SNUG, ALWAYS FOLLOWING THE SEQUENCE OF ROTATING ALL THREE SCREWS A TURN AT A TIME.

(2) Wiring Options.

The 51RV-2B VOR/ILS Receiver is equipped with bias circuits that will provide a full UP indication of the glideslope pointer and retract the glideslope flag when a VOR frequency is selected. The bias system is designed to work with the various 329B-( ) flight director indicators and approach horizons and the various 331A-( ) course indicators. The bias circuit can be removed if desired. Because the glideslope receiver must be partially disassembled to remove the bias circuit, the procedures are contained in the testing section of the 951A-1 Glideslope Receiver Planar Assembly Overhaul Manual.

The 51RV-2B also contains a bias system that automatically positions the RMI pointer to a position corresponding to the 3 o'clock position (right wing) of the aircraft when the 51RV-2B is tuned to a localizer frequency. This bias circuit can also be removed if desired. Partial disassembly of the VOR/LOC instrumentation is required in order to remove the right wing bias system. Procedures for removing the bias system are contained in the testing section of the 844A-1 VOR/LOC Instrumentation Planar Assembly Overhaul Manual.

Several wiring options can be accomplished on the self-test generator and timer module. These options provide for changing the flag in-view or flag out-of-view during self-test, and disabling the 3-second timer. Again, partial disassembly of the vhf NAV receiver is required in order to accomplish the wiring options.

Procedures are contained in the testing section of the 1051B-1 VHF NAV Receiver Planar Assembly Overhaul Manual.

(3) VOR, Localizer, and Glideslope Deviation, Flag, and TO/FROM Strapping.

The 51RV-2B will drive five VOR/LOC deviation loads, five glideslope deviation loads, four VOR/LOC flag loads, four glideslope flag loads, and two TO/FROM loads. The suggested interconnect diagram as shown in figure 402 will accept five VOR/LOC and five glideslope deviation loads, either one, two, three, or four VOR/LOC and one, two, three, or four glideslope flag loads, and two TO/FROM loads.

Figure 410 shows the jumpers required for various deviation, flag, and TO/FROM load configurations. Each VOR/LOC and glideslope deviation load (meter movements, inputs to flight control systems, etc.) should be 1000 ohms. If more than one deviation load is required for either VOR/LOC or glideslope, then the additional deviation loads must be connected in parallel and, in turn, parallel connected with the first deviation load. Also, the proper jumpers must be installed per figure 410. TO/FROM loads (two maximum) should each be 200-ohm meter movements. If two TO/FROM loads are used, parallel connect the loads and then connect directly to the 51RV-2B rear connector per figure 410. One 200-ohm TO/FROM load requires jumpering on the rear connector as shown in figure 410. No jumpers are required for any of the flag loads. The flag loads should each be 1000 ohms; if more than one is used, the additional loads must be parallel connected with the first load.

(4) Preinstallation Test.

Preinstallation test procedures are included in the adjustment/test section of this manual.

CAUTION: BE SURE THAT THE EQUIPMENT HOUSING AND MOUNT ARE ELECTRICALLY BONDED TO THE AIRFRAME.

3. REMOVAL AND REPLACEMENT.

A. 51RV-2B VOR/ILS Receiver.

(1) Removal.

(a) Loosen two knurled knobs that secure 51RV-2B to 390Y-1 shockmount.

(b) Pull 51RV-2B forward until disconnected from shockmount connector and guide pins.

(2) Replacement.

(a) Position 51RV-2B on 390Y-1 shockmount.

(b) Tighten knurled knobs that secure 51RV-2B to 390Y-1 shockmount.

(c) Safety wire knurled knobs.

B. 390Y-1 Shockmount.

(1) Removal.

(a) Remove four bolts in each shock isolator securing 390Y-1 to aircraft.

(b) Remove 390Y-1 from aircraft.

FUNCTION	NUMBER OF EXTERNAL LOADS IN PARALLEL	INSTRUCTIONS
VOR/LOC deviation	5	No jumpering required. Connect directly between P1(BP) pins 39(+R) and 40(+L).
VOR/LOC deviation	4	Jumper P1(BP) pins 39 and 30 together (+R). Then connect external loads between P1(BP) pins 39(+R) and 40(+L).
VOR/LOC deviation	3	Jumper P1(BP) pins 39 and 48 together (+R). Then connect external loads between P1(BP) pins 39(+R) and 40(+L).
VOR/LOC deviation	2	Jumper P1(BP) pins 39, 30, and 48 together (+R). Then connect external loads between P1(BP) pins 39(+R) and 40(+L).
VOR/LOC deviation	1	Jumper P1(BP) pins 39 and 49 together (+R). Then connect external load between P1(BP) pins 39(+R) and 40(+L).
VOR/LOC flag	Up to 4	No jumpering required. Connect directly between P1(BP) pins 41(+) and 42(-).
TO/FROM	2	No jumpering required. Connect directly between P1(BP) pins 43(+TO) and 44(+FROM).
TO/FROM	1	Jumper P1(BP) pins 43 and 33 together (+TO). Then connect external load between P1(BP) pins 43(+TO) and 44(+FROM).
Glideslope deviation	5	No jumpering required. Connect directly between P1(BP) pins 8(+UP) and 9(+DOWN).

51RV-2B Deviation, TO/FROM, and Flag Strapping Information (Sheet 1 of 2)
Figure 410

FUNCTION	NUMBER OF EXTERNAL LOADS IN PARALLEL	INSTRUCTIONS
Glideslope deviation	4	Jumper P1(BP) pins 8 and 2 together (+UP). Then connect external loads between P1(BP) pins 8(+UP) and 9(+DOWN).
Glideslope deviation	3	Jumper P1(BP) pins 8 and 3 together (+UP). Then connect external loads between P1(BP) pins 8(+UP) and 9(+DOWN).
Glideslope deviation	2	Jumper P1(BP) pins 8, 2, and 3 together (+UP). Then connect external loads between P1(BP) pins 8(+UP) and 9(+DOWN).
Glideslope deviation	1	Jumper P1(BP) pins 8 and 14 together (+UP). Then connect external load between P1(BP) pins 8(+UP) and 9(+DOWN).
Glideslope flag	Up to 4	No jumpering required. Connect directly between P1(BP) pins 21(+) and 22(-).

NOTE: The preceding instructions are for the primary deviation and flag circuits in the 51RV-2B. VOR, localizer, and glideslope loads are to be 1000 ohms each. TO/FROM loads are to be 200 ohms each.

51RV-2B Deviation, TO/FROM, and Flag Strapping Information (Sheet 2 of 2)
Figure 410

51RV-2B VOR/ILS Receiver - Adjustment/Test

1. GENERAL.

This section contains the information required to test the 51RV-2B VOR/ILS Receiver. Included is a preinstallation and postinstallation test procedure. No adjustments should be attempted while the unit is installed in the aircraft. Adjustments which may be made when the equipment has been removed from the aircraft are described in the overhaul manual.

2. PREINSTALLATION TEST.

A. General.

The preinstallation test is a bench test which is performed to ensure that the 51RV-2B is operating before it is installed in the aircraft. In this way, malfunctions which occur during the postinstallation test are isolated to the interconnecting wiring or other related equipment. Adjustment procedures for all 51RV-2B controls are not within the scope of the preinstallation test and are contained in the 51RV-2B VOR/ILS Receiver Overhaul Manual.

B. Equipment Required.

(1) Test Equipment.

The equipment required for the 51RV-2B preinstallation bench test is listed in figure 501. Do not use substitute test equipment without verifying (by referring to manufacturer's specifications) that the substitute and the recommended equipment are functionally equivalent. All commercial test equipment must be checked and calibrated per RTCA paper 208-53/DO-52.

CAUTION: ENSURE THAT ALL TEST EQUIPMENT IS PROPERLY CALIBRATED BEFORE BEGINNING ANY TEST. PARAGRAPH 2.D IN THIS SECTION PROVIDES PROCEDURES TO ENSURE THAT THE CORRECT PERCENTAGES OF MODULATION ARE PROVIDED BY THE 211-A, 232-A, AND 479S-3 SIGNAL GENERATORS.

(2) Power Sources.

A +27.5-volt dc ±2 percent power source, a 26-volt ±2 percent 400-Hz ±5 percent power source, and a 115-volt ±10 percent 60-Hz power source are required to test the 51RV-2B VOR/ILS Receiver.

C. Definition of Standard Test Signals.

(1) General.

The following paragraphs provide definitions for the standard test signals used to test the 51RV-2B.

NOTE: All of the standard glideslope test signals in this section are provided by the Boonton 232-A Glideslope Signal Generator. All of the standard VOR and localizer test signals are provided by the Collins 479S-3 Audio Signal Generator modulating a Boonton 211-A Signal Generator. Refer to paragraph 2.D in this section for recommended setup procedures for the signal generators.

(2) Input Levels.

Unless otherwise specified, all rf input levels refer to the voltage at the input to a 6-db, 50-ohm pad connected between the applicable signal generator and the test jig VOR/LOC ANT jack or GS ANT jack, or the 977A-1 Test Panel VHF IN jack or UHF IN jack.

(3) Standard Glideslope Test Signals.

(a) Glideslope Test Signal.

A 700-microvolt rf carrier is amplitude modulated simultaneously with a 90-Hz ±0.3 percent and a 150-Hz ±0.3 percent signal so that the sum of their separate modulation percentages equals 80 ±2 percent. (When each signal is applied separately, the carrier is modulated 40 ±2 percent.)

NOTE: A correct indication on the 232-A PERCENT MODULATION meter will be approximately 50 percent when both the 90- and 150-Hz signals are correctly adjusted, and a standard glideslope centering signal is being used. Refer to paragraph 2.D.

CAUTION: NO EFFORT SHOULD BE MADE TO OBTAIN AN 80-PERCENT MODULATION INDICATION ON THE 232-A PERCENT MODULATION METER.

(b) Glideslope Centering Signal.

A standard glideslope centering signal consists of the glideslope test signal (paragraph 2.C.(3)(a)) where the difference in depth of modulation of the 90 Hz and 150 Hz is less than 0.2 percent (0-DB on 232-A TONE RATIO control).

(c) Glideslope Deviation Signal.

A standard glideslope deviation signal consists of the glideslope test signal (paragraph 2.C.(3)(a)) where the difference in depth of modulation between the 90- and 150-Hz signals is a ratio of 2.0 db, and a deflection of 78 microamperes is indicated with an rf input level of 700 microvolts. (232-A TONE RATIO control to either 2.0 db position.)

(4) Standard VOR Test Signals.

(a) VOR Test Signal.

An rf carrier, at an output level of 1000 microvolts, is amplitude modulated simultaneously with a 30-percent, 9960-Hz subcarrier and a 30-percent, 30-Hz variable phase signal. The 9960-Hz subcarrier is frequency modulated at a deviation ratio of 16 by a 30-Hz reference phase signal. The phase of the variable signal can be varied with respect to the reference phase signal.

(b) VOR Audio Test Signal.

A standard VOR audio test signal consists of the VOR test signal described above to which is added a 1000-Hz signal amplitude modulated 30 percent.

(c) Audio Test Signal.

An rf carrier is amplitude modulated 30 percent by a 1000-Hz signal.

(5) Standard Localizer Test Signal.

(a) Localizer Test Signal.

An rf carrier, at an input level of 1000 microvolts, is amplitude modulated simultaneously with a 90-Hz ±0.3 percent and a 150-Hz ±0.3-percent signal, so that the separate modulation percentages are equal, and their sum equals 40 ±2.0 percent. (When each signal is applied separately, the carrier is modulated 20 ±2 percent.)

NOTE: A correct indication on the 211-A PERCENT MODULATION meter will be approximately 32 percent when both the 90- and 150-Hz signals are correctly adjusted and a standard localizer centering signal is being used. Refer to paragraph 2.D.

(b) Localizer Centering Signal.

A standard localizer centering signal consists of the localizer test signal (paragraph 2.C.(5)(a)) where the difference in depth of modulation of the 90 and 150 Hz is less than 0.002 volt (0.1 db). (0 db on 479S-3 TONE LOCALIZER switch.)

(c) Localizer Deviation Signal.

A standard localizer deviation signal consists of the localizer test signal (paragraph 2.C.(5)(2)) where the difference in depth of modulation of the 90 and 150 Hz is 0.093 ±0.002 volt (4.0 ±0.1 db) (either of the 4 DB positions on 479S-3 TONE LOCALIZER switch).

NOTE: When the difference in depth of modulation of the 90 Hz is greater than the 150 Hz, a deflection to the right occurs. When the difference in depth of modulation of the 150 Hz is greater than the 90 Hz, a deflection to the left occurs.

(d) Localizer Audio Signal.

A standard localizer audio signal consists of the localizer test signal (paragraph 2.C.(5)(a)) to which is added an audio signal amplitude modulating the rf carrier 30 percent.

D. Test Equipment Calibration.

(1) General.

The following paragraphs provide procedures to ensure that the percent of modulation of the recommended signal generators (Boonton 232-A Glideslope Signal Generator, and Boonton 211-A Signal Generator) are correct. Procedures are also provided for calibrating the VOR signal, and 90/150-Hz signals (for localizer) provided by the Collins 479S-3 Audio Signal Generator.

NOTE: Allow a minimum warmup time of 15 minutes before proceeding with the percent modulation calibration procedures.

(2) Boonton 232-A Glideslope Signal Generator Percent Modulation Calibration.

Ensure that the 232-A is properly calibrated and adjusted to provide a standard glideslope centering signal as described in paragraph 2.C.(3)(a). Perform the following procedures to obtain correct modulation percentages.

(a) Parallel a dc and an ac (rms) vtvm across the 232-A METER CALIB test points. (An HP-410B may be used by switching between ac and dc as required.)

NOTE: Ensure that the ac and dc meters are isolated from ground. Adjust 232-A MOD LEVEL control to approximately 40 percent before proceeding to steps (b), (c), and (d).

(b) Position 232-A CARRIER switch to OFF, MOD switch to 90/150~ and DB TONE RATIO switch to CAL 90. Adjust 232-A ZERO control until CARRIER MONITOR meter indicates 0. Observe and record dc vtvm indication (approximately +27 volts dc.)

(c) Position 232-A CARRIER switch to RF. Adjust 232-A CARRIER ADJUST control for an exact 22-volt increase as indicated on dc vtvm.

(d) Adjust 232-A MON CAL control (located on 232-A chassis) for red line indication on CARRIER MONITOR meter.

(e) Repeat steps (c) and (d) until no further adjustment is necessary.

(f) The 90-Hz tone (DB TONE RATIO to CAL 90~) can now be adjusted for exactly 40 percent modulation. Observe ac vtvm and adjust calibration. Refer to the 232-A instruction book for adjustment of the 90- and 150-Hz tone controls. After calibration, repeat steps (a) through (g).

(g) Position 232-A DB TONE RATIO switch to CAL 150~. If ac vtvm indication is not 6.37 volts ac (rms), then 232-A requires calibration. Refer to the 232-A instruction book for adjustment of the 90- and 150-Hz tone controls. After calibration, repeat steps (a) through (g).

NOTE: Percentages of modulation other than 40 percent for each tone can be computed using 1 volt ac (rms) is equal to 6.36 percent of modulation (approximately linear throughout the 232-A modulation range.)

(3) Boonton 211-A Signal Generator Percent Modulation Calibration.

Ensure that the 211-A is properly calibrated and adjusted before proceeding.

NOTE: If 211-A already has modulation monitoring jacks installed, then disregard steps (a) and (b), and proceed directly to step (c).

(a) Refer to the 211-A instruction book and locate the negative terminal of the RF MONITOR meter. Install a black tip jack on the 211-A front panel (isolated from ground). Connect a wire from negative terminal of RF MONITOR meter to black tip jack.

(b) Refer to the 211-A instruction book and locate the arm of control P304. Install a red tip jack on the 211-A front panel (isolated from ground) adjacent to the black tip jack installed in step (2). Connect a wire from the arm of P304 to red tip jack.

(c) Parallel a dc and an ac (rms) vtvm across the negative (black) and positive (red) tip jacks. Ensure that each vtvm is calibrated. (An HP-410B may be used by switching between ac and dc as required.)

NOTE: Ensure that ac and dc meters are isolated from ground.

(d) Position 211-A OSC SEL switch to OFF. Electrically zero the dc vtvm using the 211-A RF MONITOR meter ADJ ZERO control.

(e) Electrically zero the 211-A PERCENT MODULATION meter using the adjacent ADJ ZERO control.

(f) Position the 211-A OSC SEL switch to MO. Observe dc vtvm and adjust 211-A RF LEVEL control for an indication of +26 volts dc (should correspond to red line indication on RF MONITOR meter).

(g) Repeat steps (d), (e), and (f) until no further adjustments are necessary.

(h) Percentages of modulation and their corresponding ac rms voltages can now be obtained. For 20 percent modulation, observe ac vtvm and adjust 211-A

MOD LEVEL control for an indication of 3.75 volts ac (rms). For 30 percent modulation, observe ac vtvm and adjust 211-A MOD LEVEL control for an indication of 5.62 volts ac (rms).

NOTE: Percentages of modulation other than 20 and 30 percent can be computed using 1 volt ac (rms) as equal to 5.38 percent of modulation (approximately linear throughout the 211-A modulation range).

(4) Collins 479S-3 Audio Signal Generator Calibration.

(a) VOR Calibration.

1. Position 479S-3 FUNCTION SELECTOR to CAL.
2. Position SPECIFIC SIGNAL SELECTOR to 30~VARϕ.
3. Connect ac (rms) vtvm to 479S-3 MOD OUTPUT connector.
4. Open 479S-3 potentiometer access door and adjust 30~ VARϕ control for an indication of 0.5 volt rms on vtvm. Lock potentiometer shaft.
5. Position SPECIFIC SIGNAL SELECTOR to 9960 FM.
6. Adjust 9960 FM control (behind potentiometer access door) for an indication of 0.5 volt rms on vtvm. Lock potentiometer shaft.
7. Position FUNCTION SELECTOR to ODR. A standard VOR test signal is now available at the 479S-3 MOD OUTPUT connector.

(b) 90/150-Hz Localizer Tone Calibration.

1. Position 479S-3 FUNCTION SELECTOR to CAL.
2. Position SPECIFIC SIGNAL SELECTOR to 90-150~.
3. Connect ac (rms) vtvm to 479S-3 MOD OUTPUT connector.
4. Position 479S-3 TONE LOCALIZER control to CAL 90~.
5. Open 479S-3 potentiometer access door and adjust 90 control for an indication of 0.33 volt rms on vtvm. Lock potentiometer shaft.
6. Position 479S-3 TONE LOCALIZER control to CAL 150~.
7. Adjust 150 control (behind potentiometer access door) for an indication of 0.33 volt rms. Lock potentiometer shaft.
8. Position FUNCTION SELECTOR to TONE LOC. Position TONE LOCALIZER control to 0. A standard localizer centering signal is now available at the 479S-3 MOD OUTPUT connector.

E. Preinstallation Test Procedures.

(1) Use of Test Procedures.

The test procedures for the 51RV-2B are presented in tabular form. Two separate procedures are given. Procedure 1 uses standard test equipment plus a fabricated test jig and a test connector adapter unit. Procedure 2 uses standard test equipment with the Collins 977A-1 Test Panel.

Directions for using the tabular test procedures follow:

(a) The 51RV-2B should be completely assembled, and all dust covers should be in place before proceeding with the test.

(b) When any block associated with a test equipment setting is empty, all pertinent controls have been properly set in a previous step and do not have to be changed.

(c) All related test setup diagrams and tables of initial test equipment control settings are shown before the test procedure. These diagrams and tables are discussed in paragraphs 2. E. (2)(a) and 2. E. (2)(b).

(d) Functions of the various columns on the test procedure are as follows:

1. The TEST column gives the sequential test number and the name of the test being performed.

2. The TEST EQUIPMENT USED IN PROCEDURE 1 AND PROCEDURE 2 columns provide instructions pertaining to switch or control settings for the 232-A, 211-A and 479S-3 signal generators. Only the switch or control mentioned in a column for a given test need be changed or adjusted. All other switches or controls have been properly positioned or adjusted and do not have to be changed.

3. The PROCEDURE 1 USING STANDARD TEST EQUIPMENT columns provide instructions for testing the 51RV-2B using the customer-fabricated test connector adapter unit (figure 502) and test jig (figure 503). An external control unit, such as the Collins 313N-( ) is also required. The PROCEDURE column provides instructions required to perform a given test. The OUTPUT column provides test point, test equipment, test limits, and other end result indications.

4. The PROCEDURE 2 USING 977A-1 TEST PANEL columns provide instructions for testing the 51RV-2B using the Collins 977A-1 Test Panel. The FREQUENCY column shows the required frequency (frequency controls provided by 977A-1). The PROCEDURE column provides instructions required to perform a given test. The OUTPUT columns list the various outputs from the 977A-1 (DC VOLTAGE, AC VOLTS, and CRO) and also provide output test point locations (on the 977A-1), test equipment used to measure the output, and test limits or other end result indications.

NOTE: When a switch position is shown under the DC VOLTAGE, AC VOLTS, or CRO columns, it is the test technician's responsibility to ensure that the appropriate 977A-1 switches are adjusted to select the specified parameter.

5. The COMMENTS FOR PROCEDURE 1 AND PROCEDURE 2 column is used for notes and/or supplemental information pertaining to a given test. The information in this column is common to either procedure 1 or procedure 2.

(f) Performing a complete test requires that all steps of the procedure be completed in the order shown.

(g) It will be possible to isolate many problems directly from performing the test procedures. Refer to the troubleshooting section of this manual for further information concerning location of trouble.

(h) The following abbreviations are used in the test procedure.

ABBREVIATION	DEFINITION
db	Decibel (s)
Hz	Hertz
ma	Milliampere (s)
MHz	Megahertz
mv	Millivolt (s)
rms	Root mean square
rf	Radio frequency
ua	Microampere (s)
uv	Microvolt (s)
vac	Volts ac
vdc	Volts dc
NA	Not applicable

(2) Procedures.

(a) Test Setup.

Test setup diagrams are shown in figures 504 and 505. Figure 504 is the test setup for testing the 51RV-2B using standard test equipment. The test equipment shown in figure 504 is specified in figure 501. If standard test equipment is being used, fabricate the 51RV-2B test connector adapter unit and test jig as called out in figures 502 and 503.

Figure 505 is the test setup for testing the 51RV-2B using the 977A-1 Test Panel. Figure 501 specifies the test equipment shown in figure 505.

Ensure that all test equipment is properly calibrated before beginning any test (refer to paragraph 2. D in this section).

Instructions for connecting the test jig and test connector adapter unit or the 977A-1 to the 51RV-2B are contained in the test procedures.

(b) Equipment Setup.

Figure 506 is a table of initial test equipment control settings. All controls or switches on the applicable test equipments should be positioned as specified in figure 506 before beginning the test procedures. If the position of any control or switch is not specified for any piece of test equipment, that setting is not relevant to the test procedure.

NOTE: Allow 15 minutes warmup time for all test equipment.

(c) Procedures.

The test procedures are shown in figure 507. Proceed to figure 507 and begin with test number 0.1.

NOTE: Each separate preinstallation test number and name is contained on an individual page. However, test equipment control and switch settings from a previous page (test) are NOT repeated at the beginning of each new page. For many of the tests, results of previous tests will affect the results of following tests. It is therefore recommended that the complete test procedure be accomplished beginning with test 0.1. By performing the complete test procedure, all test equipment control and switch settings are given as they are required, and do not have to be changed unless instructions to do so are shown in following tests. An index of the test numbers and names follows. If it is desired to perform only a given test (without performing all of the procedures up to the desired test), then the technician should scan the TEST EQUIPMENT USED IN PROCEDURE 1 AND PROCEDURE 2 columns beginning with test 0.1, and adjust the test equipment as shown in following tests until the desired test is reached. The frequency setting of the 313N-( ) control or 977A-1 FREQUENCY switches should also be checked to ensure that the last frequency used for a previous test is selected.

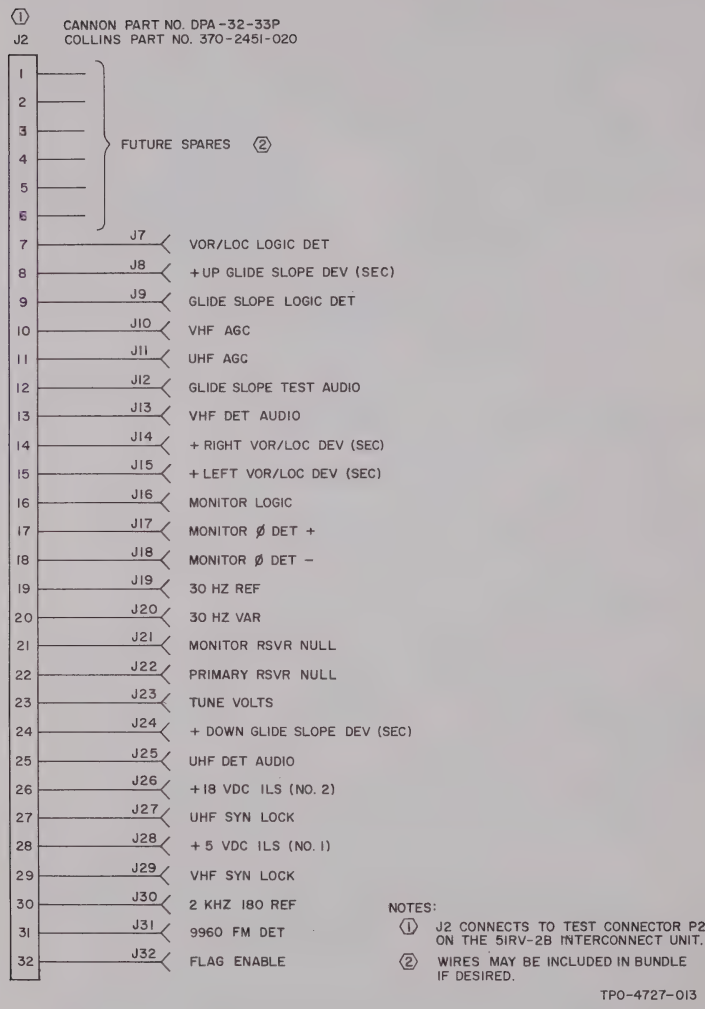
The test procedure index is as follows:

Test Number	Test Name
0.1	Test setup
1.0	Vhf sensitivity
2.0	Channel operation
3.0	Audio output
4.0	VOR output
5.0	Manual VOR instrumentation flag current and centering
6.0	TO/FROM test
7.0	VOR deviation sensitivity
8.0	VOR self-test
9.0	Manual VOR monitoring
10.0	Glideslope deviation and flag retract
11.0	RMI card sensitivity

Test Number	Test Name
12.0	RMI pointer sensitivity
13.0	RMI test
14.0	Automatic VOR monitoring
15.0	Localizer centering
16.0	Localizer flag
17.0	Localizer deviation sensitivity
18.0	RMI pointer bias
19.0	Localizer monitoring
20.0	Glideslope sensitivity
21.0	Glideslope deviation sensitivity
22.0	Glideslope balance and flag sensitivity
23.0	Glideslope monitoring
24.0	ILS self-test
25.0	End of test

EQUIPMENT	MANUFACTURER AND TYPE
51RV-2B test jig or 977A-1 Test Panel	To be locally fabricated (figure 503) Collins part number 777-1356-001
Test connector adapter unit	To be locally fabricated (figure 502) NOTE: The test connector adapter unit is used with the 51RV-2B test jig (figure 503). The 51RV-2B test jig and the test connector adapter unit are not required if the 977A-1 Test Panel is used.
Vtvm (ac)	Ballantine 310A, 300, or Hewlett-Packard 400D or 400H
Vtvm (dc)	Hewlett-Packard 410B or 410C
Audio signal generator	Collins 479S-3
Vhf signal generator	Boonton 211-A
Glideslope signal generator	Boonton 232-A
Precision track selector	Collins 479V-3
Oscilloscope	Dumont 304-A or Tektronix 315
6-db, 50-ohm pad and cable (included with 211-A and 232-A)	Boonton 505-B and 514-B
Deviation meter and flag meter	Hewlett-Packard 425-A
Power supply	+27.5 vdc regulated power supply
Signal generator (VOR/ ILS ramp tester)	Collins 479T-2

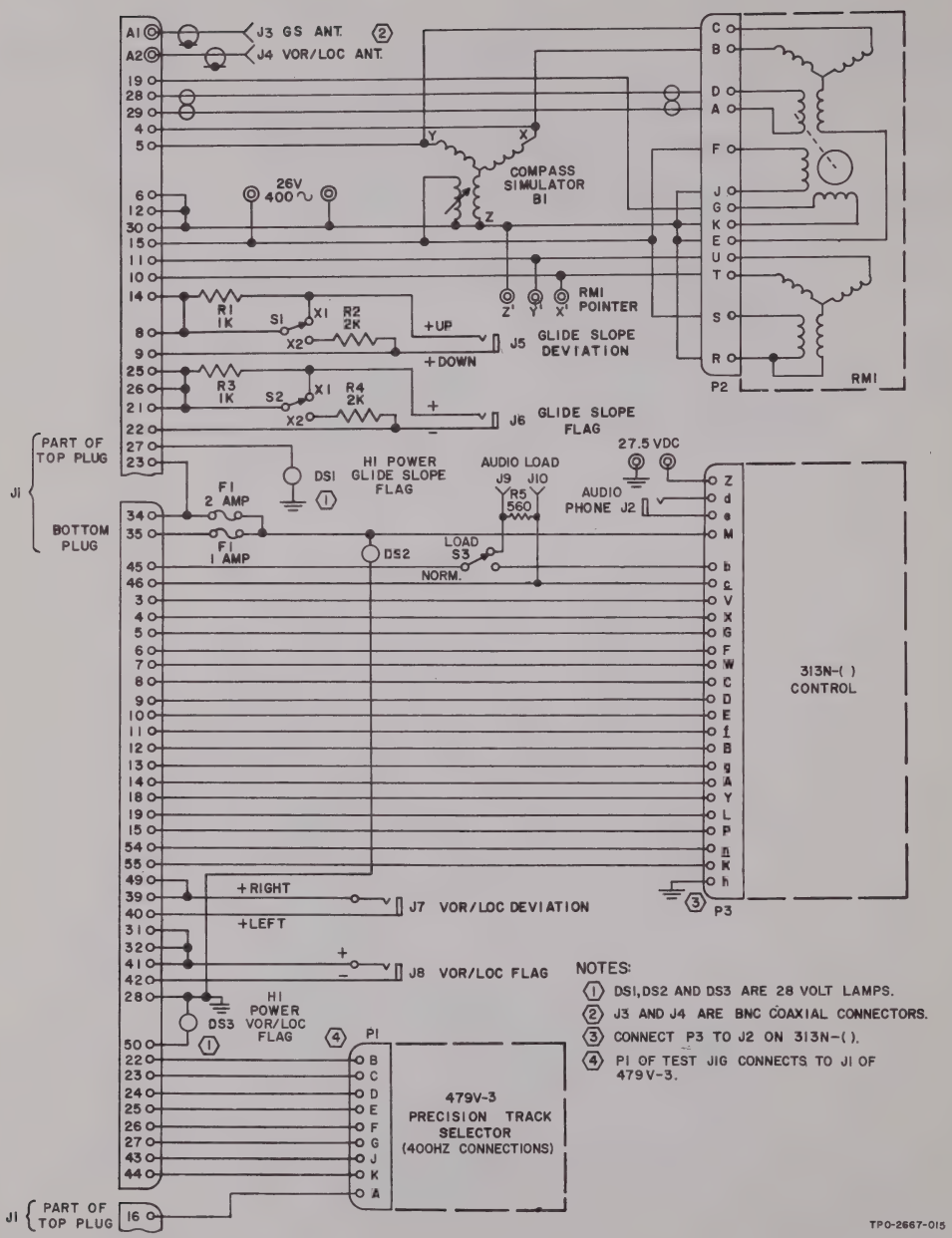
Test Equipment Required
Figure 501


① J2
CANNON PART NO. DPA-32-33P
COLLINS PART NO. 370-2451-020
1
2
3
4
5
6
FUTURE SPARES ②
7 J7 VOR/LOC LOGIC DET
8 J8 +UP GLIDE SLOPE DEV (SEC)
9 J9 GLIDE SLOPE LOGIC DET
10 J10 VHF AGC
11 J11 UHF AGC
12 J12 GLIDE SLOPE TEST AUDIO
13 J13 VHF DET AUDIO
14 J14 + RIGHT VOR/LOC DEV (SEC)
15 J15 + LEFT VOR/LOC DEV (SEC)
16 J16 MONITOR LOGIC
17 J17 MONITOR Ø DET +
18 J18 MONITOR Ø DET −
19 J19 30 HZ REF
20 J20 30 HZ VAR
21 J21 MONITOR RSVR NULL
22 J22 PRIMARY RSVR NULL
23 J23 TUNE VOLTS
24 J24 + DOWN GLIDE SLOPE DEV (SEC)
25 J25 UHF DET AUDIO
26 J26 +18 VDC ILS (NO. 2)
27 J27 UHF SYN LOCK
28 J28 + 5 VDC ILS (NO. 1)
29 J29 VHF SYN LOCK
30 J30 2 KHZ 180 REF
31 J31 9960 FM DET
32 J32 FLAG ENABLE
NOTES:
① J2 CONNECTS TO TEST CONNECTOR P2 ON THE 51RV-2B INTERCONNECT UNIT.
② WIRES MAY BE INCLUDED IN BUNDLE IF DESIRED.
TPO-4727-013

Test Connector Adapter Unit, Schematic Diagram (Sheet 1 of 2)
Figure 502

REFERENCE DESIGNATOR	COMPONENT	COLLINS PART NUMBER
J2	Connector, Cannon part number DOA-32-33P	370-2451-020
J7 through J32	Jacks, banana or tip, various colors	
Misc	5 x 10 x 2 inch aluminum chassis or 1/8 x 19 inch aluminum rack panel	
Misc	Wire, #22 AWG Teflon	

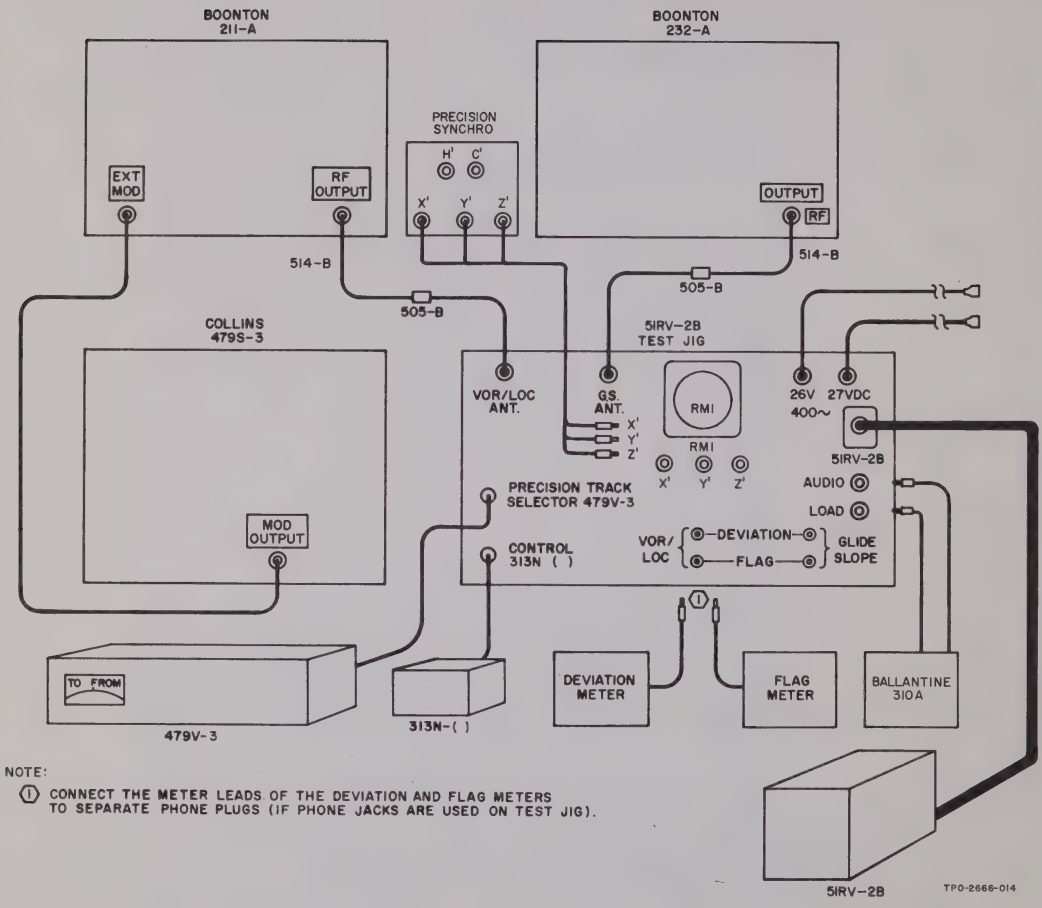
Test Connector Adapter Unit, Schematic Diagram (Sheet 2 of 2)
Figure 502



51RV-2B VOR/ILS Receiver Test Jig, Schematic Diagram (Sheet 1 of 2)
Figure 503

REFERENCE DESIGNATION	COMPONENT	COLLINS PART NUMBER
B1	Synchro transmitter	229-0076-000
	Vernier dial for B1, Theta model DA-11-120	(Obtained from Theta Instrument Corp, 22 Spielman Road, Fairfield New Jersey 07006).
DS1	Lamp, 28-volt (with socket)	
DS2	Lamp, 28-volt (with socket)	
DS3	Lamp, 28-volt (with socket)	
F1	Fuse, 2-amp (with fuseholder)	
F2	Fuse, 1-amp (with fuseholder)	
J1	Connector, Cannon part number DPX2-CA-32W2S7S-33B-0202	370-5229-00
	2 coaxial inserts for J1, Cannon part number 249-1390-000	370-5224-00
J2	Jack, phone	
J3	Jack, BNC	
J4	Jack, BNC	
J5	Jack, phone	
J6	Jack, phone	
J7	Jack, phone	
J8	Jack, phone	
J9	Jack, Johnson DF-30	
J10	Jack, Johnson DF-30	
Misc	7 banana or tip jacks	
P1	Connector, Scintilla PT06A-14-19S	371-8087-00
P2	Connector, Amphenol AN3106-22-14S	357-4034-00
P3	Connector, Scintilla PT06A-20-41S	371-6200-00
R1	Resistor, 1000 ohms, 1/4 w, 1%	
R2	Resistor, 2000 ohms, 1/4 w, 1%	
R3	Resistor, 1000 ohms, 1/4 w, 1%	
R4	Resistor, 2000 ohms, 1/4 w, 1%	
R5	Resistor, 560 ohms, 1 w, 10%	
S1	Switch, SPDT (on-on)	
S2	Switch, SPDT (on-on)	
Misc	Wire, #20 AWG Teflon	
Misc	RMI	
Misc	Control, Collins 313N-( )	Listed in figure 3.

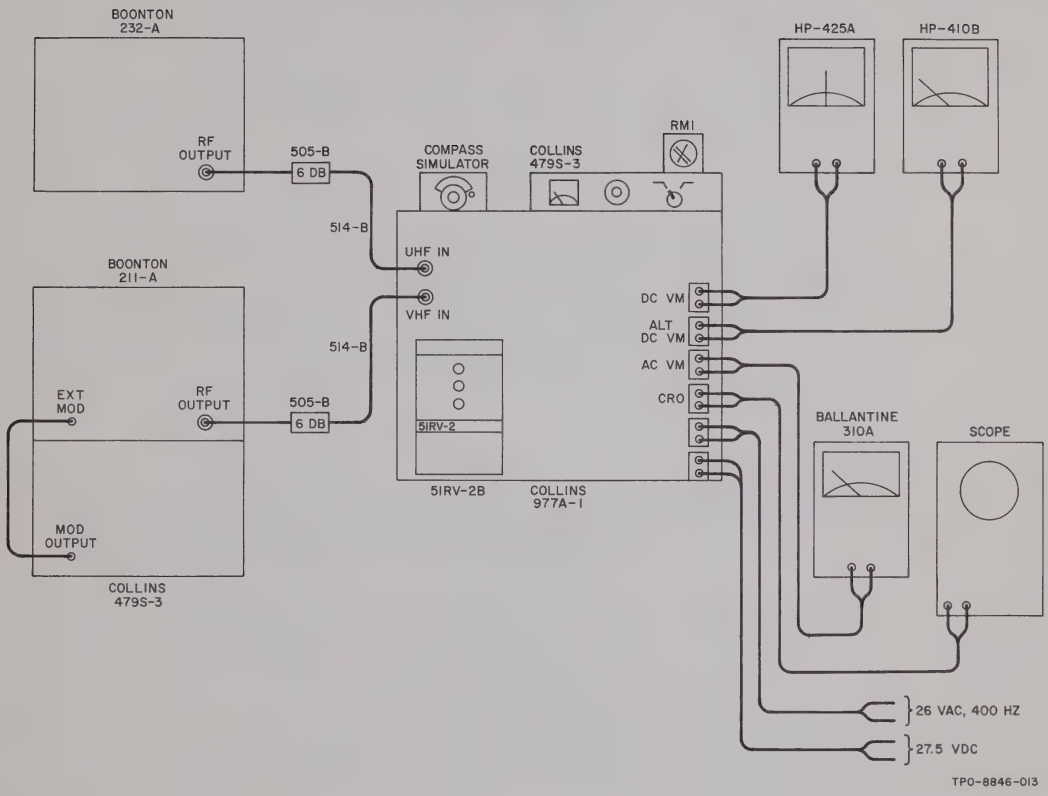
51RV-2B VOR/ILS Receiver Test Jig, Schematic Diagram (Sheet 2 of 2)
Figure 503



NOTE:

① CONNECT THE METER LEADS OF THE DEVIATION AND FLAG METERS TO SEPARATE PHONE PLUGS (IF PHONE JACKS ARE USED ON TEST JIG).

51RV-2B VOR/ILS Receiver, Preinstallation Test Setup Diagram
Using Standard Test Equipment
Figure 504



51RV-2B VOR/ILS Receiver, Preinstallation Test Setup Diagram
Using 977A-1 Test Panel
Figure 505

TEST EQUIPMENT	CONTROL OR JACK	SETTING OR POSITION	COMMENTS
Boonton 232-A Glideslope Signal Generator	RF OUTPUT jack	Connect to test jig J3 for procedure 1. Connect to 977A-1 UHF IN for procedure 2.	Connect through a 6-db, 50-ohm pad.
	POWER switch	ON.	
	FREQUENCY switch	334.4 MC.	
	OUTPUT LEVEL control	700 uv.	
	MOD switch	90-150~.	
	CARRIER switch	Per paragraph 2.D.	
	CARRIER ADJUST control		
	CARRIER MONITOR meter		
	MOD LEVEL control		
	PERCENT MODULATION meter		
	DB TONE RATIO switch	2.0, 90 Hz greater than 150 Hz after completing paragraph 2.D.	The 232-A is now adjusted to provide a standard glideslope deviation signal.
Boonton 211-A VHF Signal Generator	RF OUTPUT jack	Connect to test jig J4 for procedure 1. Connect to 977A-1 VHF IN for procedure 2.	Connect through a 6-db, 50-ohm pad.
	POWER switch	ON.	
	OSC SEL switch	MO.	
	FREQUENCY control	108.00 MC.	Carefully adjust FREQUENCY control around 108.00 MHz for maximum indication on RF MONITOR meter.
	MOD RANGE switch	100%.	
	OUTPUT LEVEL control	1000 uv.	

Test Equipment Initial Control/Switch Settings (Sheet 1 of 2)
Figure 506

TEST EQUIPMENT	CONTROL OR JACK	SETTING OR POSITION	COMMENTS
	RF LEVEL control RF MONITOR meter ADJ ZERO control MOD LEVEL control PERCENT MODULATION meter	Per paragraph 2.D.	
	MOD switch	1000~.	
	XTAL switch	114.9.	
	EXT MOD jack	Connect to 479S-3 MOD OUTPUT jack.	
Collins 479S-3 Audio Signal Generator	POWER switch	ON.	
	NOTE: Perform procedures of paragraph 2.D. before adjusting the following controls.		
	TONE LOCALIZER switch	0.	
	PHASE ANGLE SELECTOR control	0 degree.	
	FUNCTION SELECTOR switch	SPECIFIC SIGNAL.	
	SPECIFIC SIGNAL SELECTOR switch	30~VARϕ.	
	1000~ switch	OFF.	
	MOD OUTPUT jack	Connect to 211-A EXT MOD jack.	
Collins 479V-3 Precision Track Selector	400 CPS/30 CPS switch	400 CPS.	
	BEARING DEGREES switch	180 degrees.	

Test Equipment Initial Control/Switch Settings (Sheet 2 of 2)
Figure 506

TEST		TEST EQUIPMENT USED IN PROCEDURE 1 AND PROCEDURE 2			PROCEDURE 1 USING STANDARD TEST EQUIPMENT				
NO.	NAME	232-A GLIDESLOPE SIGNAL GENERATOR	211-A SIGNAL GENERATOR	479S-3 AUDIO SIGNAL GENERATOR	313N-( ) CONTROL	PROCEDURE	OUTPUT		
							TEST POINT	TEST EQUIPMENT	RESULT
0.1	Test setup	Per figure 506. NOTE: Leave all controls/ switches set per figure 506, until instructed to change any control/switch setting.	Per figure 506, adjust MOD LEVEL to 30 percent after completing paragraph 2. D. (3). NOTE: Leave all controls/ switches set per figure 506 until instructed to change any control/switch setting.	Per figure 506. NOTE: Leave all controls/ switches set per figure 506 until instructed to change any control/switch setting.	108.00 MHz	See note in COMMENTS column. Connect J1 of 51RV-2B test jig (figure 503) to P1 at rear of 51RV-2B Interconnect Unit. Connect J2 of test connector adapter unit (figure 502) to P2 at rear of 51RV-2B Interconnect Unit. Connect +27.5-vdc and 26-vac 400-Hz power to 51RV-2B test jig. Position test jig switches as follows: S1 to X1, S2 to X1, and S3 to LOAD. Use test setup shown in figure 504.			
1.0	Vhf sensitivity					Apply ac and dc power to 51RV-2B. Observe meter while slowly adjusting 211-A FREQUENCY control around 108.00 MC. Do not change 211-A FREQUENCY control after performing the above procedure.	Test connector adapter unit J10 and grd.	HP-400D	Adjusted for maximum dc.
1.1			OUTPUT LEVEL control to 3 uv.			Observe meter and record db indication.	Test jig J9 and J10 (AUDIO LOAD)	Ballantine 310A	Recorded.
1.2			OUTPUT LEVEL control to 0 uv (full counter-clockwise).			Observe meter and record db indication. Subtract db indication obtained in this test from db indication obtained in test 1.1.	Test jig J9 and J10 (AUDIO LOAD)	Ballantine 310A	Recorded. Not less than 6 db.

51RV-2B VOR/ILS Receiver, Preinstallation Test Procedures (Sheet 1 of 25)
Figure 507

TEST		TEST EQUIPMENT USED IN PROCEDURE 1 AND PROCEDURE 2			PROCEDURE 1 USING STANDARD TEST EQUIPMENT					PROCEDURE 2 USING 977A-1 TEST PANEL								COMMENTS FOR PROCEDURE 1 AND PROCEDURE 2
NO.	NAME	232-A GLIDESLOPE SIGNAL GENERATOR	211-A SIGNAL GENERATOR	479S-3 AUDIO SIGNAL GENERATOR	313N-( ) CONTROL	PROCEDURE	OUTPUT TEST POINT	OUTPUT TEST EQUIPMENT	OUTPUT RESULT	FREQUENCY	PROCEDURE	OUTPUT DC VOLTAGE	OUTPUT AC VOLTS	OUTPUT CRO	OUTPUT TEST POINT	OUTPUT TEST EQUIPMENT	OUTPUT RESULT	
0.1	Test setup	Per figure 506. NOTE: Leave all controls/ switches set per figure 506, until instructed to change any control/switch setting.	Per figure 506, adjust MOD LEVEL to 30 percent after completing paragraph 2.D.(3). NOTE: Leave all controls/ switches set per figure 506 until instructed to change any control/switch setting.	Per figure 506. NOTE: Leave all controls/ switches set per figure 506 until instructed to change any control/switch setting.	108.00 MHz	See note in COMMENTS column. Connect J1 of 51RV-2B test jig (figure 503) to P1 at rear of 51RV-2B Interconnect Unit. Connect J2 of test connector adapter unit (figure 502) to P2 at rear of 51RV-2B Interconnect Unit. Connect +27.5-vdc and 26-vac 400-Hz power to 51RV-2B test jig. Position test jig switches as follows: S1 to X1, S2 to X1, and S3 to LOAD. Use test setup shown in figure 504.				108.00 MHz	See note in COMMENTS column. Connect 51RV-2B to 51RV-2 connector on 977A-1. Connect +27.5-vdc and 26-vac, 400-Hz power to 977A-1. Position 977A-1 switches as follows: AC and DC INPUT POWER to OFF (down), MODE to VOR, 900 ~ and NAV DISABLE to OFF (down), VOR UP-LT, and DN-RT SELF-TEST to OFF (down), and DEVIATION ALARM TEST to OFF. Use test setup shown in figure 505.	NA	NA	NA				NOTE: The Collins 479V-3 Precision Track Selector and the RMI should be connected to the test jig or the 977A-1 as shown on the test jig schematic diagram (figure 503) or the 977A-1 schematic diagram (refer to the 51RV-2 Test Equipment Instruction Book, Collins part number 523-0759909).
1.0	Vhf sensitivity					Apply ac and dc power to 51RV-2B. Observe meter while slowly adjusting 211-A FREQUENCY control around 108.00 MC. Do not change 211-A FREQUENCY control after performing the above procedure.	Test connector adapter unit J10 and grd.	HP-400D	Adjusted for maximum dc.		Position AC and DC INPUT POWER switches to ON. Observe meter while slowly adjusting 211-A FREQUENCY control around 108.00 MC. Do not change 211-A FREQUENCY control after performing the above procedure.	VHF AGC			DC VM	HP-400D	Adjusted for maximum dc.	A maximum dc indication (of agc) shows that the 211-A is adjusted to 108.00 MHz.
1.1			OUTPUT LEVEL control to 3 uv.			Observe meter and record db indication.	Test jig J9 and J10 (AUDIO LOAD)	Ballantine 310A	Recorded.		Observe meter and record db indication.		VL AF		AC VM	Ballantine 310A	Recorded.	
1.2			OUTPUT LEVEL control to 0 uv (full counter-clockwise).			Observe meter and record db indication. Subtract db indication obtained in this test from db indication obtained in test 1.1.	Test jig J9 and J10 (AUDIO LOAD)	Ballantine 310A	Recorded. Not less than 6 db.		Observe meter and record db indication. Subtract db indication obtained in this step from db indication obtained in step 1.1				AC VM	Ballantine 310A	Recorded. Not less than 6 db.	This test checks the s+n/n ratio at 108.00 MHz with a 3-uv input. NOTE: Steps 1.1 and 1.2 can be repeated at any desired frequency between 108.00 and 117.95 MHz.

51RV-2B VOR/ILS Receiver, Preinstallation Test Procedures (Sheet 1 of 25)
Figure 507

TEST		TEST EQUIPMENT USED IN PROCEDURE 1 AND PROCEDURE 2			PROCEDURE 1 USING STANDARD TEST EQUIPMENT				
NO.	NAME	232-A GLIDESLOPE SIGNAL GENERATOR	211-A SIGNAL GENERATOR	479S-3 AUDIO SIGNAL GENERATOR	313N-( ) CONTROL	PROCEDURE	OUTPUT		
							TEST POINT	TEST EQUIPMENT	RESULT
2.0	Channel operation		OUTPUT LEVEL control to 1000 uv.			Observe oscilloscope. (211-A tuned to 108.00 MHz.)	Test jig J9 and J10 (AUDIO LOAD)	Oscilloscope	1000-Hz waveform observed.
2.1					108.70 MHz 109.15 MHz 110.20 MHz 111.35 MHz 112.40 MHz 113.55 MHz 114.60 MHz 115.10 MHz 115.75 MHz 116.80 MHz 117.95 MHz	In turn, tune 211-A and 313N-( ) control to each listed frequency. Observe oscilloscope at each frequency.	Test jig J9 and J10 (AUDIO LOAD)	Oscilloscope	1000-Hz waveform observed.

51RV-2B VOR/ILS Receiver, Preinstallation Test Procedures (Sheet 2 of 25)
Figure 507

PROCEDURE 2 USING 977A-1 TEST PANEL								COMMENTS FOR PROCEDURE 1 AND PROCEDURE 2
FREQUENCY	PROCEDURE	OUTPUT						
		DC VOLTAGE	AC VOLTS	CRO	TEST POINT	TEST EQUIPMENT	RESULT	
108.	Observe oscilloscope. (211-A tuned to 108.00 MHz.)			VL AF	CRO	Oscilloscope	1000-Hz waveform observed.	
108.70 MHz 109.15 MHz 110.20 MHz 111.35 MHz 112.40 MHz 113.55 MHz 114.60 MHz 115.10 MHz 115.75 MHz 116.80 MHz 117.95 MHz	In turn, tune 211-A and 977A-1 FREQUENCY switches to each listed frequency (see note below). Observe oscilloscope at each frequency. NOTE: Change 977A-1 MODE switch to ILS for each odd-tenth MHz frequency as follows: (108.70, 109.15, and 111.35 MHz.) All other frequencies shown at left should be checked with MODE switch positioned to VOR.				CRO	Oscilloscope	1000-Hz waveform observed.	This test checks the channeling of the vhf synthesizer planar assembly, and the vhf NAV receiver planar assembly.

TEST		TEST EQUIPMENT USED IN PROCEDURE 1 AND PROCEDURE 2			PROCEDURE 1 USING STANDARD TEST EQUIPMENT				
NO.	NAME	232-A GLIDESLOPE SIGNAL GENERATOR	211-A SIGNAL GENERATOR	479S-3 AUDIO SIGNAL GENERATOR	313N-( ) CONTROL	PROCEDURE	OUTPUT		
							TEST POINT	TEST EQUIPMENT	RESULT
3.0	Audio Output		OSC SEL switch to XTAL.		114.90 MHz	Adjust 211-A FREQUENCY control around 114.90 MC for maximum indication on RF MONITOR meter. Adjust 211-A RF LEVEL control for red line indication on RF MONITOR meter.			
3.1						Observe meter.	Test jig J9 and J10 (AUDIO LOAD)	Ballantine 310A	At least 7.75 vac.

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Figure 507

TEST		TEST EQUIPMENT USED IN PROCEDURE 1 AND PROCEDURE 2			PROCEDURE 1 USING STANDARD TEST EQUIPMENT					PROCEDURE 2 USING 977A-1 TEST PANEL								COMMENTS FOR PROCEDURE 1 AND PROCEDURE 2
NO.	NAME	232-A GLIDESLOPE SIGNAL GENERATOR	211-A SIGNAL GENERATOR	479S-3 AUDIO SIGNAL GENERATOR	313N-( ) CONTROL	PROCEDURE	OUTPUT			FREQUENCY	PROCEDURE	OUTPUT						
							TEST POINT	TEST EQUIPMENT	RESULT			DC VOLTAGE	AC VOLTS	CRO	TEST POINT	TEST EQUIPMENT	RESULT	
2.0	Channel operation		OUTPUT LEVEL control to 1000 uv.			Observe oscilloscope. (211-A tuned to 108.00 MHz.)	Test jig J9 and J10 (AUDIO LOAD)	Oscilloscope	1000-Hz waveform observed.		Observe oscilloscope. (211-A tuned to 108.00 MHz.)			VL AF	CRO	Oscilloscope	1000-Hz waveform observed.	
2.1					108.70 MHz 109.15 MHz 110.20 MHz 111.35 MHz 112.40 MHz 113.55 MHz 114.60 MHz 115.10 MHz 115.75 MHz 116.80 MHz 117.95 MHz	In turn, tune 211-A and 313N-( ) control to each listed frequency. Observe oscilloscope at each frequency.	Test jig J9 and J10 (AUDIO LOAD)	Oscilloscope	1000-Hz waveform observed.	108.70 MHz 109.15 MHz 110.20 MHz 111.35 MHz 112.40 MHz 113.55 MHz 114.60 MHz 115.10 MHz 115.75 MHz 116.80 MHz 117.95 MHz	In turn, tune 211-A and 977A-1 FREQUENCY switches to each listed frequency (see note below). Observe oscilloscope at each frequency. NOTE: Change 977A-1 MODE switch to ILS for each odd-tenth MHz frequency as follows: (108.70, 109.15, and 111.35 MHz.) All other frequencies shown at left should be checked with MODE switch positioned to VOR.				CRO	Oscilloscope	1000-Hz waveform observed.	This test checks the channeling of the vhf synthesizer planar assembly, and the vhf NAV receiver planar assembly.

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Figure 507

TEST		TEST EQUIPMENT USED IN PROCEDURE 1 AND PROCEDURE 2			PROCEDURE 1 USING STANDARD TEST EQUIPMENT				
NO.	NAME	232-A GLIDESLOPE SIGNAL GENERATOR	211-A SIGNAL GENERATOR	479S-3 AUDIO SIGNAL GENERATOR	313N-( ) CONTROL	PROCEDURE	OUTPUT		
							TEST POINT	TEST EQUIPMENT	RESULT
3.0	Audio Output		OSC SEL switch to XTAL.		114.90 MHz	Adjust 211-A FREQUENCY control around 114.90 MC for maximum indication on RF MONITOR meter. Adjust 211-A RF LEVEL control for red line indication on RF MONITOR meter.			
3.1						Observe meter.	Test jig J9 and J10 (AUDIO LOAD)	Ballantine 310A	At least 7.75 vac.

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Figure 507

PROCEDURE 2 USING 977A-1 TEST PANEL								COMMENTS FOR PROCEDURE 1 AND PROCEDURE 2
FREQUENCY	PROCEDURE	DC VOLTAGE	AC VOLTS	CRO	TEST POINT	TEST EQUIPMENT	RESULT	
14.90 MHz	Adjust 211-A FREQUENCY control around 114.90 MC for maximum indication on RF MONITOR meter. Adjust 211-A RF LEVEL control for red line indication on RF MONITOR METER.							
	Observe meter.		VL AF		AC VM	Ballantine 310A	At least 7.75 vac.	This corresponds to a 100-mw output into a 600-ohm load. A General Radio 583A audio output meter can also be used for this test (output of 583A is in mw).

TEST		TEST EQUIPMENT USED IN PROCEDURE 1 AND PROCEDURE 2			PROCEDURE 1 USING STANDARD TEST EQUIPMENT				
NO.	NAME	232-A GLIDESLOPE SIGNAL GENERATOR	211-A SIGNAL GENERATOR	479S-3 AUDIO SIGNAL GENERATOR	313N-( ) CONTROL	PROCEDURE	TEST POINT	TEST EQUIPMENT	RESULT
4.0	VOR output		MOD switch to EXT.			Recheck 211-A for 30 percent modulation. Observe meter.	Test connector adapter unit J13 and ground	HP-400D	0.5 ±0.02 vac.

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Figure 507

TEST		TEST EQUIPMENT USED IN PROCEDURE 1 AND PROCEDURE 2			PROCEDURE 1 USING STANDARD TEST EQUIPMENT					PROCEDURE 2 USING 977A-1 TEST PANEL								COMMENTS FOR PROCEDURE 1 AND PROCEDURE 2
NO.	NAME	232-A GLIDESLOPE SIGNAL GENERATOR	211-A SIGNAL GENERATOR	479S-3 AUDIO SIGNAL GENERATOR	313N-( ) CONTROL	PROCEDURE	OUTPUT			FREQUENCY	PROCEDURE							
							TEST POINT	TEST EQUIPMENT	RESULT			DC VOLTAGE	AC VOLTS	CRO	TEST POINT	TEST EQUIPMENT	RESULT	
3.0	Audio Output		OSC SEL switch to XTAL.		114.90 MHz	Adjust 211-A FREQUENCY control around 114.90 MC for maximum indication on RF MONITOR meter. Adjust 211-A RF LEVEL control for red line indication on RF MONITOR meter.				14.90 MHz	Adjust 211-A FREQUENCY control around 114.90 MC for maximum indication on RF MONITOR meter. Adjust 211-A RF LEVEL control for red line indication on RF MONITOR METER.							
3.1						Observe meter.	Test jig J9 and J10 (AUDIO LOAD)	Ballantine 310A	At least 7.75 vac.		Observe meter.		VL AF		AC VM	Ballantine 310A	At least 7.75 vac.	This corresponds to a 100-mw output into a 600-ohm load. A General Radio 583A audio output meter can also be used for this test (output of 583A is in mw).

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Figure 507

TEST		TEST EQUIPMENT USED IN PROCEDURE 1 AND PROCEDURE 2			PROCEDURE 1 USING STANDARD TEST EQUIPMENT				
NO.	NAME	232-A GLIDESLOPE SIGNAL GENERATOR	211-A SIGNAL GENERATOR	479S-3 AUDIO SIGNAL GENERATOR	313N-( ) CONTROL	PROCEDURE	TEST POINT	TEST EQUIPMENT	RESULT
4.0	VOR output		MOD switch to EXT.			Recheck 211-A for 30 percent modulation. Observe meter.	Test connector adapter unit J13 and ground	HP-400D	0.5 ±0.02 vac.

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Figure 507

PROCEDURE 2 USING 977A-1 TEST PANEL								COMMENTS FOR PROCEDURE 1 AND PROCEDURE 2
FREQUENCY	PROCEDURE	OUTPUT						
		DC VOLTAGE	AC VOLTS	CRO	TEST POINT	TEST EQUIPMENT	RESULT	
	Recheck 211-A for 30 percent modulation. Observe meter (flag).		VHF DET AF		AC VM	HP-400D	0.5 ±0.02 vac.	

TEST		TEST EQUIPMENT USED IN PROCEDURE 1 AND PROCEDURE 2			PROCEDURE 1 USING STANDARD TEST EQUIPMENT				
NO.	NAME	232-A GLIDESLOPE SIGNAL GENERATOR	211-A SIGNAL GENERATOR	479S-3 AUDIO SIGNAL GENERATOR	313N-( ) CONTROL	PROCEDURE	OUTPUT		
							TEST POINT	TEST EQUIPMENT	RESULT
5.0	Manual VOR instrumentation flag current and centering			FUNCTION SELECTOR switch to ODR.		If paragraph 2.D were completed, 211-A PERCENT MODULATION meter should now indicate approximately 52 percent Adjust 479V-3 Precision Track Selector BEARING DEGREES switch to 180.			
5.1						Observe meter (flag).	Test jig J8	HP-425A	Not less than 300 ua, and not more than 510 ua.
5.2						Observe meter (deviation).	Test jig J7, and test connector adapter unit J14 and J15.	HP-425A	0 ±12 ua (each measurement).

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Figure 507

TEST		TEST EQUIPMENT USED IN PROCEDURE 1 AND PROCEDURE 2			PROCEDURE 1 USING STANDARD TEST EQUIPMENT					PROCEDURE 2 USING 977A-1 TEST PANEL								COMMENTS FOR PROCEDURE 1 AND PROCEDURE 2
NO.	NAME	232-A GLIDESLOPE SIGNAL GENERATOR	211-A SIGNAL GENERATOR	479S-3 AUDIO SIGNAL GENERATOR	313N-( ) CONTROL	PROCEDURE	TEST POINT	TEST EQUIPMENT	RESULT	FREQUENCY	PROCEDURE	OUTPUT						
												DC VOLTAGE	AC VOLTS	CRO	TEST POINT	TEST EQUIPMENT	RESULT	
4.0	VOR output		MOD switch to EXT.			Recheck 211-A for 30 percent modulation. Observe meter.	Test connector adapter unit J13 and ground	HP-400D	0.5 ±0.02 vac.		Recheck 211-A for 30 percent modulation. Observe meter (flag).		VHF DET AF		AC VM	HP-400D	0.5 ±0.02 vac.	

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Figure 507

TEST		TEST EQUIPMENT USED IN PROCEDURE 1 AND PROCEDURE 2			PROCEDURE 1 USING STANDARD TEST EQUIPMENT				
NO.	NAME	232-A GLIDESLOPE SIGNAL GENERATOR	211-A SIGNAL GENERATOR	479S-3 AUDIO SIGNAL GENERATOR	313N-( ) CONTROL	PROCEDURE	OUTPUT		
							TEST POINT	TEST EQUIPMENT	RESULT
5.0	Manual VOR instrumentation flag current and centering			FUNCTION SELECTOR switch to ODR.		If paragraph 2.D were completed, 211-A PERCENT MODULATION meter should now indicate approximately 52 percent Adjust 479V-3 Precision Track Selector BEARING DEGREES switch to 180.			
5.1						Observe meter (flag).	Test jig J8	HP-425A	Not less than 300 ua, and not more than 510 ua.
5.2						Observe meter (deviation).	Test jig J7, and test connector adapter unit J14 and J15.	HP-425A	0 ±12 ua (each measurement).

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Figure 507

PROCEDURE 2 USING 977A-1 TEST PANEL								COMMENTS FOR PROCEDURE 1 AND PROCEDURE 2
FREQUENCY	PROCEDURE	OUTPUT						
		DC VOLTAGE	AC VOLTS	CRO	TEST POINT	TEST EQUIPMENT	RESULT	
	If paragraph 2.D were completed, 211-A PERCENT MODULATION meter should now indicate approximately 52 percent. Adjust 479V-3 Precision Track Selector BEARING DEGREES switch to 180.							
	Observe meter (flag).	VL FLAG			DC VM	HP-425A	Not less than 300 ua, and not more than 510 ua.	
	Observe meter (deviation).	VL DEV DIF			DC VM	HP-425A	0 ±12 ua.	

TEST		TEST EQUIPMENT USED IN PROCEDURE 1 AND PROCEDURE 2			PROCEDURE 1 USING STANDARD TEST EQUIPMENT				
NO.	NAME	232-A GLIDESLOPE SIGNAL GENERATOR	211-A SIGNAL GENERATOR	479S-3 AUDIO SIGNAL GENERATOR	313N-( ) CONTROL	PROCEDURE	OUTPUT		
							TEST POINT	TEST EQUIPMENT	RESULT
6.0	TO-FROM test					Observe meter (to-from).		479V-3 to-from meter	TO.
6.1						Position 479V-3 BEARING DEGREES switch to 0 degree. Observe meter (to-from).		479V-3 to-from meter	FROM.

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Figure 507

TEST		TEST EQUIPMENT USED IN PROCEDURE 1 AND PROCEDURE 2			PROCEDURE 1 USING STANDARD TEST EQUIPMENT					PROCEDURE 2 USING 977A-1 TEST PANEL									COMMENTS FOR PROCEDURE 1 AND PROCEDURE 2
NO.	NAME	232-A GLIDESLOPE SIGNAL GENERATOR	211-A SIGNAL GENERATOR	479S-3 AUDIO SIGNAL GENERATOR	313N-( ) CONTROL	PROCEDURE	OUTPUT			FREQUENCY	PROCEDURE	OUTPUT							
							TEST POINT	TEST EQUIPMENT	RESULT			DC VOLTAGE	AC VOLTS	CRO	TEST POINT	TEST EQUIPMENT	RESULT	
5.0	Manual VOR instrumentation flag current and centering			FUNCTION SELECTOR switch to ODR.		If paragraph 2.D were completed, 211-A PERCENT MODULATION meter should now indicate approximately 52 percent Adjust 479V-3 Precision Track Selector BEARING DEGREES switch to 180.					If paragraph 2.D were completed, 211-A PERCENT MODULATION meter should now indicate approximately 52 percent. Adjust 479V-3 Precision Track Selector BEARING DEGREES switch to 180.								
5.1						Observe meter (flag).	Test jig J8	HP-425A	Not less than 300 ua, and not more than 510 ua.		Observe meter (flag).	VL FLAG			DC VM	HP-425A	Not less than 300 ua, and not more than 510 ua.	
5.2						Observe meter (deviation).	Test jig J7, and test connector adapter unit J14 and J15.	HP-425A	0 ±12 ua (each measurement).		Observe meter (deviation).	VL DEV DIF			DC VM	HP-425A	0 ±12 ua.	

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Figure 507

TEST		TEST EQUIPMENT USED IN PROCEDURE 1 AND PROCEDURE 2			PROCEDURE 1 USING STANDARD TEST EQUIPMENT				
NO.	NAME	232-A GLIDESLOPE SIGNAL GENERATOR	211-A SIGNAL GENERATOR	479S-3 AUDIO SIGNAL GENERATOR	313N-( ) CONTROL	PROCEDURE	OUTPUT		
							TEST POINT	TEST EQUIPMENT	RESULT
6.0	TO-FROM test					Observe meter (to-from).		479V-3 to-from meter	TO.
6.1						Position 479V-3 BEARING DEGREES switch to 0 degree. Observe meter (to-from).		479V-3 to-from meter	FROM.

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Figure 507

PROCEDURE 2 USING 977A-1 TEST PANEL								COMMENTS FOR PROCEDURE 1 AND PROCEDURE 2
FREQUENCY	PROCEDURE	OUTPUT						
		DC VOLTAGE	AC VOLTS	CRO	TEST POINT	TEST EQUIPMENT	RESULT	
	Observe meter (to-from).					479V-3 to-from meter.	TO.	
	Position 479V-3 BEARING DEGREES switch to 0 degree. Observe meter (to-from).					 479V-3 to-from meter	 FROM.	

TEST		TEST EQUIPMENT USED IN PROCEDURE 1 AND PROCEDURE 2			PROCEDURE 1 USING STANDARD TEST EQUIPMENT				
NO.	NAME	232-A GLIDESLOPE SIGNAL GENERATOR	211-A SIGNAL GENERATOR	479S-3 AUDIO SIGNAL GENERATOR	312N-( ) CONTROL	PROCEDURE	OUTPUT		
							TEST POINT	TEST EQUIPMENT	RESULT
7.0	VOR deviation sensitivity			Adjust PHASE ANGLE SELECTOR to 10 degrees.		Adjust 479V-3 BEARING DEGREES switch to 180 degrees.			
7.1						Observe meter.	Test jig J7	HP-425A	150 ±8 ua to the right.

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Figure 507

TEST		TEST EQUIPMENT USED IN PROCEDURE 1 AND PROCEDURE 2			PROCEDURE 1 USING STANDARD TEST EQUIPMENT					PROCEDURE 2 USING 977A-1 TEST PANEL								COMMENTS FOR PROCEDURE 1 AND PROCEDURE 2
NO.	NAME	232-A GLIDESLOPE SIGNAL GENERATOR	211-A SIGNAL GENERATOR	479S-3 AUDIO SIGNAL GENERATOR	313N-( ) CONTROL	PROCEDURE	OUTPUT			FREQUENCY	PROCEDURE	OUTPUT						
							TEST POINT	TEST EQUIPMENT	RESULT			DC VOLTAGE	AC VOLTS	CRO	TEST POINT	TEST EQUIPMENT	RESULT	
6.0	TO-FROM test					Observe meter (to-from).		479V-3 to-from meter	TO.		Observe meter (to-from).					479V-3 to-from meter.	TO.	
6.1						Position 479V-3 BEARING DEGREES switch to 0 degree. Observe meter (to-from).		479V-3 to-from meter	FROM.		Position 479V-3 BEARING DEGREES switch to 0 degree. Observe meter (to-from).					479V-3 to-from meter	FROM.	

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Figure 507

TEST		TEST EQUIPMENT USED IN PROCEDURE 1 AND PROCEDURE 2			PROCEDURE 1 USING STANDARD TEST EQUIPMENT				
NO.	NAME	232-A GLIDESLOPE SIGNAL GENERATOR	211-A SIGNAL GENERATOR	479S-3 AUDIO SIGNAL GENERATOR	313N-( ) CONTROL	PROCEDURE	OUTPUT		
							TEST POINT	TEST EQUIPMENT	RESULT
7.0	VOR deviation sensitivity			Adjust PHASE ANGLE SELECTOR to 10 degrees.		Adjust 479V-3 BEARING DEGREES switch to 180 degrees.			
7.1						Observe meter.	Test jig J7	HP-425A	150 ±8 ua to the right.

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Figure 507

PROCEDURE 2 USING 977A-1 TEST PANEL								COMMENTS FOR PROCEDURE 1 AND PROCEDURE 2
FREQUENCY	PROCEDURE	OUTPUT						
		DC VOLTAGE	AC VOLTS	CRO	TEST POINT	TEST EQUIPMENT	RESULT	
	Observe meter.	VL DEV PRI			DC VM	HP-425A	150 ±8 ua to the right.	

TEST		TEST EQUIPMENT USED IN PROCEDURE 1 AND PROCEDURE 2			PROCEDURE 1 USING STANDARD TEST EQUIPMENT				
NO.	NAME	232-A GLIDESLOPE SIGNAL GENERATOR	211-A SIGNAL GENERATOR	479S-3 AUDIO SIGNAL GENERATOR	313N-( ) CONTROL	PROCEDURE	OUTPUT		
							TEST POINT	TEST EQUIPMENT	RESULT
8.0	VOR self-test					Adjust 479V-3 BEARING DEGREES switch to 0 degree. Actuate VOR test switch on 51RV-2B front panel and observe meter. Release VOR test switch.	Test jig J7 and J8	HP-425A	0 ±15 ua at J7, and 300 to 510 ua at J8.

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Figure 507

TEST		TEST EQUIPMENT USED IN PROCEDURE 1 AND PROCEDURE 2			PROCEDURE 1 USING STANDARD TEST EQUIPMENT					PROCEDURE 2 USING 977A-1 TEST PANEL								COMMENTS FOR PROCEDURE 1 AND PROCEDURE 2
NO.	NAME	232-A GLIDESLOPE SIGNAL GENERATOR	211-A SIGNAL GENERATOR	479S-3 AUDIO SIGNAL GENERATOR	313N-( ) CONTROL	PROCEDURE	OUTPUT			FREQUENCY	PROCEDURE	OUTPUT						
							TEST POINT	TEST EQUIPMENT	RESULT			DC VOLTAGE	AC VOLTS	CRO	TEST POINT	TEST EQUIPMENT	RESULT	
7.0	VOR deviation sensitivity			Adjust PHASE ANGLE SELECTOR to 10 degrees.		Adjust 479V-3 BEARING DEGREES switch to 180 degrees.												
7.1						Observe meter.	Test jig J7	HP-425A	150 ±8 ua to the right.		Observe meter.	VL DEV PRI			DC VM	HP-425A	150 ±8 ua to the right.	

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Figure 507

TEST		TEST EQUIPMENT USED IN PROCEDURE 1 AND PROCEDURE 2			PROCEDURE 1 USING STANDARD TEST EQUIPMENT				
NO.	NAME	232-A GLIDESLOPE SIGNAL GENERATOR	211-A SIGNAL GENERATOR	479S-3 AUDIO SIGNAL GENERATOR	313N-( ) CONTROL	PROCEDURE	OUTPUT		
							TEST POINT	TEST EQUIPMENT	RESULT
8.0	VOR self-test					Adjust 479V-3 BEARING DEGREES switch to 0 degree. Actuate VOR test switch on 51RV-2B front panel and observe meter. Release VOR test switch.	Test jig J7 and J8	HP-425A	0 ±15 ua at J7, and 300 to 510 ua at J8.

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Figure 507

PROCEDURE 2 USING 977A-1 TEST PANEL								COMMENTS FOR PROCEDURE 1 AND PROCEDURE 2
FREQUENCY	PROCEDURE	OUTPUT						
		DC VOLTAGE	AC VOLTS	CRO	TEST POINT	TEST EQUIPMENT	RESULT	
	Adjust 479V-3 BEARING DEGREES switch to 0 degree.							
	Position 977A-1 VOR SELF-TEST switch on (up), and observe meter.	VL DEV DIF VL FLAG			DC VM DC VM	HP-425A HP-425A	0 ±15 ua. 300 to 510 ua.	
	Position 977A-1 VOR SELF-TEST switch to off.							

TEST		TEST EQUIPMENT USED IN PROCEDURE 1 AND PROCEDURE 2			PROCEDURE 1 USING STANDARD TEST EQUIPMENT				
NO.	NAME	232-A GLIDESLOPE SIGNAL GENERATOR	211-A SIGNAL GENERATOR	479S-3 AUDIO SIGNAL GENERATOR	313N-( ) CONTROL	* PROCEDURE	OUTPUT		
							TEST POINT	TEST EQUIPMENT	RESULT
9.0	Manual VOR monitoring			Adjust PHASE ANGLE SELECTOR to 0 degree before performing procedure.		Install a shorting phone plug (tip and sleeve jumpered) in test jig J7. Adjust 479V-3 BEARING DEGREES switch to 180 degrees.			
9.1				See procedure.		Slowly adjust 479S-3 PHASE ANGLE SELECTOR (either direction) until test jig HI POWER VOR/LOC FLAG light just goes off. Observe dial indication. Remove shorting plug from J7.	PHASE ANGLE SELECTOR dial.	479S-3	0.8 ±0.4 degree.

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Figure 507

TEST		TEST EQUIPMENT USED IN PROCEDURE 1 AND PROCEDURE 2			PROCEDURE 1 USING STANDARD TEST EQUIPMENT					PROCEDURE 2 USING 977A-1 TEST PANEL								COMMENTS FOR PROCEDURE 1 AND PROCEDURE 2
NO.	NAME	232-A GLIDESLOPE SIGNAL GENERATOR	211-A SIGNAL GENERATOR	479S-3 AUDIO SIGNAL GENERATOR	313N-( ) CONTROL	PROCEDURE	OUTPUT			FREQUENCY	PROCEDURE	OUTPUT						
							TEST POINT	TEST EQUIPMENT	RESULT			DC VOLTAGE	AC VOLTS	CRO	TEST POINT	TEST EQUIPMENT	RESULT	
8.0	VOR self-test					Adjust 479V-3 BEARING DEGREES switch to 0 degree.					Adjust 479V-3 BEARING DEGREES switch to 0 degree.							
						Actuate VOR test switch on 51RV-2B front panel and observe meter.	Test jig J7 and J8	HP-425A	0 ±15 ua at J7, and 300 to 510 ua at J8.		Position 977A-1 VOR SELF-TEST switch on (up), and observe meter.	VL DEV DIF VL FLAG			DC VM DC VM	HP-425A HP-425A	0 ±15 ua. 300 to 510 ua.	
						Release VOR test switch.					Position 977A-1 VOR SELF-TEST switch to off.							

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Figure 507

TEST		TEST EQUIPMENT USED IN PROCEDURE 1 AND PROCEDURE 2			PROCEDURE 1 USING STANDARD TEST EQUIPMENT				
NO.	NAME	232-A GLIDESLOPE SIGNAL GENERATOR	211-A SIGNAL GENERATOR	479S-3 AUDIO SIGNAL GENERATOR	313N-( ) CONTROL	PROCEDURE	OUTPUT		
							TEST POINT	TEST EQUIPMENT	RESULT
9.0	Manual VOR monitoring			Adjust PHASE ANGLE SELECTOR to 0 degree before performing procedure.		Install a shorting phone plug (tip and sleeve jumpered) in test jig J7. Adjust 479V-3 BEARING DEGREES switch to 180 degrees.			
9.1				See procedure.		Slowly adjust 479S-3 PHASE ANGLE SELECTOR (either direction) until test jig HI POWER VOR/LOC FLAG light just goes off. Observe dial indication. Remove shorting plug from J7.	PHASE ANGLE SELECTOR dial.	479S-3	0.8 ±0.4 degree.

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Figure 507

PROCEDURE 2 USING 977A-1 TEST PANEL								COMMENTS FOR PROCEDURE 1 AND PROCEDURE 2
FREQUENCY	PROCEDURE	OUTPUT						
		DC VOLTAGE	AC VOLTS	CRO	TEST POINT	TEST EQUIPMENT	RESULT	
	Position DC VOLTAGE switch S3 to VL DEV PRI. Install a shorting plug across 977A-1 ALT DC VM jacks. Rotate DC VOLTAGE switch selector to select switch S1. (See note in COMMENTS column.) Adjust 479V-3 BEARING DEGREES switch to 180 degrees.							NOTE: DC VOLTAGE switch S3 is permanently connected to the ALT DC VM jacks. The parameters provided by S3 are always available at the ALT DC VM jacks. The parameters provided by the remaining DC VOLTAGE switches (S1 and S2) are only available at the DC VM jacks. Therefore parameters from S1 and S3 or S2 and S3 can be observed simultaneously. The parameters provided by S3 are also available at the DC VM jacks, but only when the DC VOLTAGE switch selector is positioned to select S3.
	Slowly adjust 479S-3 PHASE ANGLE SELECTOR (either direction) until 977A-1 VL POWER FLAG light just goes off. Observe dial indication. Remove shorting plug from ALT DC VM jacks.				PHASE ANGLE SELECTOR dial	479S-3	0.8 ±0.4 degree.	

TEST		TEST EQUIPMENT USED IN PROCEDURE 1 AND PROCEDURE 2			PROCEDURE 1 USING STANDARD TEST EQUIPMENT				
NO.	NAME	232-A GLIDESLOPE SIGNAL GENERATOR	211-A SIGNAL GENERATOR	479S-3 AUDIO SIGNAL GENERATOR	313N-( ) CONTROL	PROCEDURE	OUTPUT		
							TEST POINT	TEST EQUIPMENT	RESULT
10.0	Glideslope deviation and flag retract			Adjust PHASE ANGLE SELECTOR to 0 degree.		Observe meter (for 51RV-2B with Collins part numbers 522-4280-001 and 522-4977-001). NOTE: 51RV-2B with Collins part number 777-1480-001 will provide a zero indication at J5 and J6 during this test.	Test jig J5 J6	HP-425A	1200 ±200 ua at J5, and 300 to 510 ua at J6 (0 ua at J5, 0 ua at J6 for 51RV-2B pn 777-1480-001.)

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Figure 507

TEST		TEST EQUIPMENT USED IN PROCEDURE 1 AND PROCEDURE 2			PROCEDURE 1 USING STANDARD TEST EQUIPMENT					PROCEDURE 2 USING 977A-1 TEST PANEL								COMMENTS FOR PROCEDURE 1 AND PROCEDURE 2
NO.	NAME	232-A GLIDESLOPE SIGNAL GENERATOR	211-A SIGNAL GENERATOR	479S-3 AUDIO SIGNAL GENERATOR	313N-( ) CONTROL	PROCEDURE	OUTPUT TEST POINT	OUTPUT TEST EQUIPMENT	OUTPUT RESULT	FREQUENCY	PROCEDURE	OUTPUT DC VOLTAGE	OUTPUT AC VOLTS	OUTPUT CRO	OUTPUT TEST POINT	OUTPUT TEST EQUIPMENT	OUTPUT RESULT	
9.0	Manual VOR monitoring			Adjust PHASE ANGLE SELECTOR to 0 degree before performing procedure.		Install a shorting phone plug (tip and sleeve jumpered) in test jig J7. Adjust 479V-3 BEARING DEGREES switch to 180 degrees.					Position DC VOLTAGE switch S3 to VL DEV PRI. Install a shorting plug across 977A-1 ALT DC VM jacks. Rotate DC VOLTAGE switch selector to select switch S1. (See note in COMMENTS column.) Adjust 479V-3 BEARING DEGREES switch to 180 degrees.							NOTE: DC VOLTAGE switch S3 is permanently connected to the ALT DC VM jacks. The parameters provided by S3 are always available at the ALT DC VM jacks. The parameters provided by the remaining DC VOLTAGE switches (S1 and S2) are only available at the DC VM jacks. Therefore parameters from S1 and S3 or S2 and S3 can be observed simultaneously. The parameters provided by S3 are also available at the DC VM jacks, but only when the DC VOLTAGE switch selector is positioned to select S3.
9.1				See procedure.		Slowly adjust 479S-3 PHASE ANGLE SELECTOR (either direction) until test jig HI POWER VOR/LOC FLAG light just goes off. Observe dial indication. Remove shorting plug from J7.	PHASE ANGLE SELECTOR dial.	479S-3	0.8 ±0.4 degree.		Slowly adjust 479S-3 PHASE ANGLE SELECTOR (either direction) until 977A-1 VL POWER FLAG light just goes off. Observe dial indication. Remove shorting plug from ALT DC VM jacks.				PHASE ANGLE SELECTOR dial	479S-3	0.8 ±0.4 degree.	

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Figure 507

TEST		TEST EQUIPMENT USED IN PROCEDURE 1 AND PROCEDURE 2			PROCEDURE 1 USING STANDARD TEST EQUIPMENT				
NO.	NAME	232-A GLIDESLOPE SIGNAL GENERATOR	211-A SIGNAL GENERATOR	479S-3 AUDIO SIGNAL GENERATOR	313N-( ) CONTROL	PROCEDURE	OUTPUT		
							TEST POINT	TEST EQUIPMENT	RESULT
10.0	Glideslope deviation and flag retract			Adjust PHASE ANGLE SELECTOR to 0 degree.		Observe meter (for 51RV-2B with Collins part numbers 522-4280-001 and 522-4977-001). NOTE: 51RV-2B with Collins part number 777-1480-001 will provide a zero indication at J5 and J6 during this test.	Test jig J5 J6	HP-425A	1200 ±200 ua at J5, and 300 to 510 ua at J6 (0 ua at J5, 0 ua at J6 for 51RV-2B pn 777-1480-001.)

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Figure 507

PROCEDURE 2 USING 977A-1 TEST PANEL								COMMENTS FOR PROCEDURE 1 AND PROCEDURE 2
FREQUENCY	PROCEDURE	OUTPUT						
		DC VOLTAGE	AC VOLTS	CRO	TEST POINT	TEST EQUIPMENT	RESULT	
	Observe meter (for 51RV-2B with Collins part numbers 522-4280-001 and 522-4977-001). NOTE: 51RV-2B with Collins part number 777-1480-001 will provide a zero indication for each of the above steps.	GS DEV DIF GS FLAG			DC VM DC VM	HP-425A HP-425A	1200 ±200 ua 300 to 510 ua. (0 ua for each of the above with 51RV-2B pn 777-1480-001.)	

TEST		TEST EQUIPMENT USED IN PROCEDURE 1 AND PROCEDURE 2			PROCEDURE 1 USING STANDARD TEST EQUIPMENT				
							OUTPUT		
NO.	NAME	232-A GLIDESLOPE SIGNAL GENERATOR	211-A SIGNAL GENERATOR	479S-3 AUDIO SIGNAL GENERATOR	313N-( ) CONTROL	PROCEDURE	TEST POINT	TEST EQUIPMENT	RESULT
11.0	RMI card sensitivity					Adjust test jig compass simulator to 0 degree. Carefully rotate compass simulator dial while observing RMI card. When RMI card just starts to move, observe dial and record degrees indication.	Test jig compass simulator dial		Recorded.
11.1						Do not reset compass simulator dial to 0 degree. Carefully rotate compass simulator in the same direction as rotated in test 11.0, and observe RMI card. When RMI card just starts to move, observe dial and record degrees indication.	Test jig		Recorded.
11.2						Repeat test 11.1 eight more times. After completion, observe dial and note difference between first indication (test 11.0) and last indication (test 11.2).	Test jig compass simulator dial		3 to 4 degrees difference for ten readings (average 0.3 to 0.4 degree for each step).

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Figure 507

TEST		TEST EQUIPMENT USED IN PROCEDURE 1 AND PROCEDURE 2			PROCEDURE 1 USING STANDARD TEST EQUIPMENT					PROCEDURE 2 USING 977A-1 TEST PANEL								COMMENTS FOR PROCEDURE 1 AND PROCEDURE 2
NO.	NAME	232-A GLIDESLOPE SIGNAL GENERATOR	211-A SIGNAL GENERATOR	479S-3 AUDIO SIGNAL GENERATOR	313N-( ) CONTROL	PROCEDURE	OUTPUT			FREQUENCY	PROCEDURE	OUTPUT						
							TEST POINT	TEST EQUIPMENT	RESULT			DC VOLTAGE	AC VOLTS	CRO	TEST POINT	TEST EQUIPMENT	RESULT	
10.0	Glideslope deviation and flag retract			*Adjust PHASE ANGLE SELECTOR to 0 degree.		Observe meter (for 51RV-2B with Collins part numbers 522-4280-001 and 522-4977-001). NOTE: 51RV-2B with Collins part number 777-1480-001 will provide a zero indication at J5 and J6 during this test.	Test jig J5 J6	HP-425A	1200 ±200 ua at J5, and 300 to 510 ua at J6 (0 ua at J5, 0 ua at J6 for 51RV-2B pn 777-1480-001.)		Observe meter (for 51RV-2B with Collins part numbers 522-4280-001 and 522-4977-001). NOTE: 51RV-2B with Collins part number 777-1480-001 will provide a zero indication for each of the above steps.	GS DEV DIF GS FLAG			DC VM DC VM	HP-425A HP-425A	1200 ±200 ua 300 to 510 ua. (0 ua for each of the above with 51RV-2B pn 777-1480-001.)	

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Figure 507

TEST		TEST EQUIPMENT USED IN PROCEDURE 1 AND PROCEDURE 2			PROCEDURE 1 USING STANDARD TEST EQUIPMENT				
NO.	NAME	232-A GLIDESLOPE SIGNAL GENERATOR	211-A SIGNAL GENERATOR	479S-3 AUDIO SIGNAL GENERATOR	313N-( ) CONTROL	PROCEDURE	OUTPUT		
							TEST POINT	TEST EQUIPMENT	RESULT
11.0	RMI card sensitivity					Adjust test jig compass simulator to 0 degree. Carefully rotate compass simulator dial while observing RMI card. When RMI card just starts to move, observe dial and record degrees indication.	Test jig compass simulator dial		Recorded.
11.1						Do not reset compass simulator dial to 0 degree. Carefully rotate compass simulator in the same direction as rotated in test 11.0, and observe RMI card. When RMI card just starts to move, observe dial and record degrees indication.	Test jig		Recorded.
11.2						Repeat test 11.1 eight more times. After completion, observe dial and note difference between first indication (test 11.0) and last indication (test 11.2).	Test jig compass simulator dial		3 to 4 degrees difference for ten readings (average 0.3 to 0.4 degree for each step).

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Figure 507

PROCEDURE 2 USING 977A-1 TEST PANEL								COMMENTS FOR PROCEDURE 1 AND PROCEDURE 2
FREQUENCY	PROCEDURE	OUTPUT						
		DC VOLTAGE	AC VOLTS	CRO	TEST POINT	TEST EQUIPMENT	RESULT	
	Ensure that compass simulator is properly connected to TB2 on rear of 977A-1 as shown in 51RV-2 Test Equipment Instruction Book. Adjust compass simulator to 0 degree. Carefully rotate compass simulator dial while observing RMI card. When RMI card starts to move, observe dial and record indication.				Compass simulator dial		Recorded.	
	Do not reset compass simulator dial to 0 degree. Carefully rotate compass simulator in the same direction as rotated in test 11.0, and observe RMI card. When RMI card just starts to move, observe dial and record degrees indication.				Compass simulator dial		Recorded.	
	Repeat test 11.1 eight more times. After completion, observe dial and note difference between first indication (test 11.0) and last indication (test 11.2).				Compass simulator dial		3 to 4 degrees difference for ten readings (average 0.3 to 0.4 degree for each step).	

TEST		TEST EQUIPMENT USED IN PROCEDURE 1 AND PROCEDURE 2			PROCEDURE 1 USING STANDARD TEST EQUIPMENT				
NO.	NAME	232-A GLIDESLOPE SIGNAL GENERATOR	211-A SIGNAL GENERATOR	479S-3 AUDIO SIGNAL GENERATOR	313N-( ) CONTROL	PROCEDURE	OUTPUT		
							TEST POINT	TEST EQUIPMENT	RESULT
12.0	RMI pointer sensitivity.					Connect precision synchro to test jig X', Y', and Z' jacks. Connect Ballantine 310A to precision synchro H' and C' jacks.			
						Observe meter and null precision synchro.	Precision synchro H' and C' jacks.	Ballantine 310A	Null.
						Observe and record dial indication on precision synchro.			Recorded.
12.1				Adjust PHASE ANGLE SELECTOR to +1 degree.		Observe meter and null precision synchro.	Precision synchro H' and C' jacks.	Ballantine 310A	Null.
						Observe dial indication on precision synchro.			1 ±0.5 degree difference betw null in test 12.0 and null in test 12.1

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Figure 507

TEST		TEST EQUIPMENT USED IN PROCEDURE 1 AND PROCEDURE 2			PROCEDURE 1 USING STANDARD TEST EQUIPMENT					PROCEDURE 2 USING 977A-1 TEST PANEL								COMMENTS FOR PROCEDURE 1 AND PROCEDURE 2
NO.	NAME	232-A GLIDESLOPE SIGNAL GENERATOR	211-A SIGNAL GENERATOR	479S-3 AUDIO SIGNAL GENERATOR	313N-( ) CONTROL	PROCEDURE	OUTPUT			FREQUENCY	PROCEDURE	OUTPUT						
							TEST POINT	TEST EQUIPMENT	RESULT			DC VOLTAGE	AC VOLTS	CRO	TEST POINT	TEST EQUIPMENT	RESULT	
11.0	RMI card sensitivity					Adjust test jig compass simulator to 0 degree. Carefully rotate compass simulator dial while observing RMI card. When RMI card just starts to move, observe dial and record degrees indication.	Test jig compass simulator dial		Recorded.		Ensure that compass simulator is properly connected to TB2 on rear of 977A-1 as shown in 51RV-2 Test Equipment Instruction Book. Adjust compass simulator to 0 degree. Carefully rotate compass simulator dial while observing RMI card. When RMI card starts to move, observe dial and record indication.				Compass simulator dial		Recorded.	
11.1						Do not reset compass simulator dial to 0 degree. Carefully rotate compass simulator in the same direction as rotated in test 11.0, and observe RMI card. When RMI card just starts to move, observe dial and record degrees indication.	Test jig		Recorded.		Do not reset compass simulator dial to 0 degree. Carefully rotate compass simulator in the same direction as rotated in test 11.0, and observe RMI card. When RMI card just starts to move, observe dial and record degrees indication.				Compass simulator dial		Recorded.	
11.2						Repeat test 11.1 eight more times. After completion, observe dial and note difference between first indication (test 11.0) and last indication (test 11.2).	Test jig compass simulator dial		3 to 4 degrees difference for ten readings (average 0.3 to 0.4 degree for each step).		Repeat test 11.1 eight more times. After completion, observe dial and note difference between first indication (test 11.0) and last indication (test 11.2).				Compass simulator dial		3 to 4 degrees difference for ten readings (average 0.3 to 0.4 degree for each step).	

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Figure 507

TEST		TEST EQUIPMENT USED IN PROCEDURE 1 AND PROCEDURE 2			PROCEDURE 1 USING STANDARD TEST EQUIPMENT				
NO.	NAME	232-A GLIDESLOPE SIGNAL GENERATOR	211-A SIGNAL GENERATOR	479S-3 AUDIO SIGNAL GENERATOR	313N-( ) CONTROL	PROCEDURE	OUTPUT		
							TEST POINT	TEST EQUIPMENT	RESULT
12.0	RMI pointer sensitivity.					Connect precision synchro to test jig X', Y', and Z' jacks. Connect Ballantine 310A to precision synchro H' and C' jacks.			
						Observe meter and null precision synchro.	Precision synchro H' and C' jacks.	Ballantine 310A	Null.
						Observe and record dial indication on precision synchro.			Recorded.
12.1				Adjust PHASE ANGLE SELECTOR to +1 degree.		Observe meter and null precision synchro.	Precision synchro H' and C' jacks.	Ballantine 310A	Null.
						Observe dial indication on precision synchro.			1 ±0.5 degree difference between null in test 12.0 and null in test 12.1

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Figure 507

PROCEDURE 2 USING 977A-1 TEST PANEL								COMMENTS FOR PROCEDURE 1 AND PROCEDURE 2
FREQUENCY	PROCEDURE	OUTPUT						
		DC VOLTAGE	AC VOLTS	CRO	TEST POINT	TEST EQUIPMENT	RESULT	
	Connect precision synchro to TB2 on rear of 977A-1 as shown in 51RV-2 Test Equipment Instruction Book. Connect Ballantine 310A to precision synchro H' and C' jacks.							
	Observe meter and null precision synchro.				Precision synchro H' and C' jacks.	Ballantine 310A	Null.	
	Observe and record dial indication on precision synchro.						Recorded.	
	Observe meter and null precision synchro.				Precision synchro H' and C' jacks.	Ballantine 310A	Null.	
en	Observe dial indication on precision synchro.						1 ±0.5 degree difference between null in test 12.0 and null in test 12.1.	

TEST		TEST EQUIPMENT USED IN PROCEDURE 1 AND PROCEDURE 2			PROCEDURE 1 USING STANDARD TEST EQUIPMENT				
							OUTPUT		
NO.	NAME	232-A GLIDESLOPE SIGNAL GENERATOR	211-A SIGNAL GENERATOR	479S-3 AUDIO SIGNAL GENERATOR	313N-( ) CONTROL	PROCEDURE	TEST POINT	TEST EQUIPMENT	RESULT
13.0	RMI test					Actuate VOR test switch on 51RV-2B front panel and observe RMI. Release VOR test switch.		RMI pointer	180 ±4.0 degrees

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Figure 507

TEST		TEST EQUIPMENT USED IN PROCEDURE 1 AND PROCEDURE 2			PROCEDURE 1 USING STANDARD TEST EQUIPMENT					PROCEDURE 2 USING 977A-1 TEST PANEL								COMMENTS FOR PROCEDURE 1 AND PROCEDURE 2
NO.	NAME	232-A GLIDESLOPE SIGNAL GENERATOR	211-A SIGNAL GENERATOR	479S-3 AUDIO SIGNAL GENERATOR	313N-( ) CONTROL	PROCEDURE	OUTPUT TEST POINT	OUTPUT TEST EQUIPMENT	OUTPUT RESULT	FREQUENCY	PROCEDURE	OUTPUT DC VOLTAGE	OUTPUT AC VOLTS	OUTPUT CRO	OUTPUT TEST POINT	OUTPUT TEST EQUIPMENT	OUTPUT RESULT	
12.0	RMI pointer sensitivity.					Connect precision synchro to test jig X', Y', and Z' jacks. Connect Ballantine 310A to precision synchro H' and C' jacks.					Connect precision synchro to TB2 on rear of 977A-1 as shown in 51RV-2 Test Equipment Instruction Book. Connect Ballantine 310A to precision synchro H' and C' jacks.								
						Observe meter and null precision synchro.	Precision synchro H' and C' jacks.	Ballantine 310A	Null.		Observe meter and null precision synchro.				Precision synchro H' and C' jacks.	Ballantine 310A	Null.	
						Observe and record dial indication on precision synchro.			Recorded.		Observe and record dial indication on precision synchro.						Recorded.	
12.1				Adjust PHASE ANGLE SELECTOR to +1 degree.		Observe meter and null precision synchro.	Precision synchro H' and C' jacks.	Ballantine 310A	Null.		Observe meter and null precision synchro.				Precision synchro H' and C' jacks.	Ballantine 310A	Null.	
						Observe dial indication on precision synchro.			1 ±0.5 degree difference between null in test 12.0 and null in test 12.1		Observe dial indication on precision synchro.						1 ±0.5 degree difference between null in test 12.0 and null in test 12.1.	

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Figure 507

TEST		TEST EQUIPMENT USED IN PROCEDURE 1 AND PROCEDURE 2			PROCEDURE 1 USING STANDARD TEST EQUIPMENT				
							OUTPUT		
NO.	NAME	232-A GLIDESLOPE SIGNAL GENERATOR	211-A SIGNAL GENERATOR	479S-3 AUDIO SIGNAL GENERATOR	313N-( ) CONTROL	PROCEDURE	TEST POINT	TEST EQUIPMENT	RESULT
13.0	RMI test					Actuate VOR test switch on 51RV-2B front panel and observe RMI. Release VOR test switch.		RMI pointer	180 ±4.0 degrees

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Figure 507

PROCEDURE 2 USING 977A-1 TEST PANEL								COMMENTS FOR PROCEDURE 1 AND PROCEDURE 2
FREQUENCY	PROCEDURE	OUTPUT						
		DC VOLTAGE	AC VOLTS	CRO	TEST POINT	TEST EQUIPMENT	RESULT	
	Position 977A-1 VOR SELF-TEST switch on (up) and observe RMI. Position 977A-1 VOR SELF-TEST switch to off.					RMI pointer.	180 ±4.0 degrees.	

TEST		TEST EQUIPMENT USED IN PROCEDURE 1 AND PROCEDURE 2			PROCEDURE 1 USING STANDARD TEST EQUIPMENT				
							OUTPUT		
NO.	NAME	232-A GLIDESLOPE SIGNAL GENERATOR	211-A SIGNAL GENERATOR	479S-3 AUDIO SIGNAL GENERATOR	313N-( ) CONTROL	PROCEDURE	TEST POINT	TEST EQUIPMENT	RESULT
14.0	Automatic VOR monitoring					Connect Ballantine 310A to modulation jacks on 211-A front panel (installed per paragraph 2.D.(3)(a) and 2.D.(3)(b)).			
						Observe meter and record db indication and vac indication.	211-A modulation jacks	Ballantine 310A	Recorded.
14.1			Adjust MOD LEVEL control per procedure			Observe test jig HI POWER VOR/LOC FLAG light and slowly adjust 211-A MOD LEVEL control counterclockwise until light just goes off.			
						Observe db indication on meter. Adjust 211-A MOD LEVEL control clockwise until Ballantine 310A indicates same vac figure recorded in test 14.0.	211-A modulation jacks	Ballantine 310A	6 ±2 db less than db indication recorded in test 14.0.
14.2				PHASE ANGLE SELECTOR to 0 degree then per procedure.		Remove 400-Hz power from test jig.			
						Observe meter and adjust 479S-3 PHASE ANGLE SELECTOR above 0 degree until result is obtained.	Test connector adapter unit J16 and grd	Ballantine 310A	Meter indicates 0 volt.
						Observe dial.	PHASE ANGLE SELECTOR dial	479S-3	1 ±0.5 degree.
14.3						Observe meter and adjust 479S-3 PHASE ANGLE SELECTOR below 0 degree until result is obtained.	Test connector adapter unit J16 and grd	Ballantine 310A	Meter indicates 0 volt.
						Observe dial.	PHASE ANGLE SELECTOR dial	479S-3	359 ±0.5 degrees.
						Reapply 400-Hz power to test jig.			

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Figure 507

TEST		TEST EQUIPMENT USED IN PROCEDURE 1 AND PROCEDURE 2			PROCEDURE 1 USING STANDARD TEST EQUIPMENT					PROCEDURE 2 USING 977A-1 TEST PANEL								COMMENTS FOR PROCEDURE 1 AND PROCEDURE 2
							OUTPUT					OUTPUT						
NO.	NAME	232-A GLIDESLOPE SIGNAL GENERATOR	211-A SIGNAL GENERATOR	479S-3 AUDIO SIGNAL GENERATOR	313N-( ) CONTROL	PROCEDURE	TEST POINT	TEST EQUIPMENT	RESULT	FREQUENCY	PROCEDURE	DC VOLTAGE	AC VOLTS	CRO	TEST POINT	TEST EQUIPMENT	RESULT	
13.0	RMI test					Actuate VOR test switch on 51RV-2B front panel and observe RMI. Release VOR test switch.		RMI pointer	180 ±4.0 degrees.		Position 977A-1 VOR SELF-TEST switch on (up) and observe RMI. Position 977A-1 VOR SELF-TEST switch to off.					RMI pointer.	180 ±4.0 degrees.	

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Figure 507

TEST		TEST EQUIPMENT USED IN PROCEDURE 1 AND PROCEDURE 2			PROCEDURE 1 USING STANDARD TEST EQUIPMENT				
							OUTPUT		
NO.	NAME	232-A GLIDESLOPE SIGNAL GENERATOR	211-A SIGNAL GENERATOR	479S-3 AUDIO SIGNAL GENERATOR	313N-( ) CONTROL	PROCEDURE	TEST POINT	TEST EQUIPMENT	RESULT
14.0	Automatic VOR monitoring					Connect Ballantine 310A to modulation jacks on 211-A front panel (installed per paragraph 2.D.(3)(a) and 2.D.(3)(b)).			
						Observe meter and record db indication and vac indication.	211-A modulation jacks	Ballantine 310A	Recorded.
14.1			Adjust MOD LEVEL control per procedure			Observe test jig HI POWER VOR/LOC FLAG light and slowly adjust 211-A MOD LEVEL control counterclockwise until light just goes off.			
						Observe db indication on meter. Adjust 211-A MOD LEVEL control clockwise until Ballantine 310A indicates same vac figure recorded in test 14.0.	211-A modulation jacks	Ballantine 310A	6 ±2 db less than db indication recorded in test 14.0.
14.2				PHASE ANGLE SELECTOR to 0 degree then per procedure.		Remove 400-Hz power from test jig.			
						Observe meter and adjust 479S-3 PHASE ANGLE SELECTOR above 0 degree until result is obtained.	Test connector adapter unit J16 and grd	Ballantine 310A	Meter indicates 0 volt.
						Observe dial.	PHASE ANGLE SELECTOR dial	479S-3	1 ±0.5 degree.
14.3						Observe meter and adjust 479S-3 PHASE ANGLE SELECTOR below 0 degree until result is obtained.	Test connector adapter unit J16 and grd	Ballantine 310A	Meter indicates 0 volt.
						Observe dial.	PHASE ANGLE SELECTOR dial	479S-3	359 ±0.5 degrees.
						Reapply 400-Hz power to test jig.			

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Figure 507

PROCEDURE 2 USING 977A-1 TEST PANEL								COMMENTS FOR PROCEDURE 1 AND PROCEDURE 2
FREQUENCY	PROCEDURE	OUTPUT						
		DC VOLTAGE	AC VOLT	CRO	TEST POINT	TEST EQUIPMENT	RESULT	
	Connect Ballantine 310A to modulation jacks on 211-A front panel (installed per paragraph 2. D. (3)(a) and 2. D. (3)(b)).							
	Observe meter and record db indication and vac indication.				211-A modulation jacks	Ballantine 310A	Recorded.	
	Observe 977A-1 VL POWER FLAG light and slowly adjust 211-A MOD LEVEL control counterclockwise until light just goes off.							
	Observe db indication on meter.				211-A modulation jacks	Ballantine 310A	6 ±2 db less than db indication recorded in test 14. 0.	
	Adjust 211-A MOD LEVEL control clockwise until Ballantine 310A indicates same vac figure recorded in test 14. 0.							
	Position AC INPUT POWER switch off (down).			MON LOGIC	CRO	Ballantine 310A	Meter indicates 0 volt.	
	Observe meter and adjust 479S-3 PHASE ANGLE SELECTOR above 0 degree until result is obtained.							
	Observe dial.				PHASE ANGLE SELECTOR dial.	479S-3	1 ±0. 5 degree.	
	Observe meter and adjust 479S-3 PHASE ANGLE SELECTOR below 0 degree until result is obtained.			MON LOGIC	CRO	Ballantine 310A	Meter indicates 0 volt.	
	Observe dial.				PHASE ANGLE SELECTOR dial.	479S-3	359 ±0. 5 degrees.	
	Position AC INPUT POWER switch to on.							
	Position MODE switch to ILS.							

TEST		TEST EQUIPMENT USED IN PROCEDURE 1 AND PROCEDURE 2			PROCEDURE 1 USING STANDARD TEST EQUIPMENT				
NO.	NAME	232-A GLIDESLOPE SIGNAL GENERATOR	211-A SIGNAL GENERATOR	479S-3 AUDIO SIGNAL GENERATOR	313N-( ) CONTROL	PROCEDURE	OUTPUT		
							TEST POINT	TEST EQUIPMENT	RESULT
15.0	Localizer centering		XTAL switch to 110.1	FUNCTION SELECTOR to TONE LOC.	110.10 MHz	Adjust 211-A FREQUENCY control around 110.10 MHz for maximum indication on RF MONITOR meter. Adjust 211-A RF LEVEL control for red line indication on RF MONITOR meter.			
15.1						Observe meter.	Test jig J7	HP-425A	0 ±3 ua.

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Figure 507

TEST		TEST EQUIPMENT USED IN PROCEDURE 1 AND PROCEDURE 2			PROCEDURE 1 USING STANDARD TEST EQUIPMENT					PROCEDURE 2 USING 977A-1 TEST PANEL								COMMENTS FOR PROCEDURE 1 AND PROCEDURE 2
							OUTPUT					OUTPUT						
NO.	NAME	232-A GLIDESLOPE SIGNAL GENERATOR	211-A SIGNAL GENERATOR	479S-3 AUDIO SIGNAL GENERATOR	313N-( ) CONTROL	PROCEDURE	TEST POINT	TEST EQUIPMENT	RESULT	FREQUENCY	PROCEDURE	DC VOLTAGE	AC VOLT	CRO	TEST POINT	TEST EQUIPMENT	RESULT	
14.0	Automatic VOR monitoring					Connect Ballantine 310A to modulation jacks on 211-A front panel (installed per paragraph 2.D.(3)(a) and 2.D.(3)(b)).					Connect Ballantine 310A to modulation jacks on 211-A front panel (installed per paragraph 2.D.(3)(a) and 2.D.(3)(b)).							
						Observe meter and record db indication and vac indication.	211-A modulation jacks	Ballantine 310A	Recorded.		Observe meter and record db indication and vac indication.				211-A modulation jacks	Ballantine 310A	Recorded.	
14.1			Adjust MOD LEVEL control per procedure			Observe test jig HI POWER VOR/LOC FLAG light and slowly adjust 211-A MOD LEVEL control counterclockwise until light just goes off.					Observe 977A-1 VL POWER FLAG light and slowly adjust 211-A MOD LEVEL control counterclockwise until light just goes off.							
						Observe db indication on meter. Adjust 211-A MOD LEVEL control clockwise until Ballantine 310A indicates same vac figure recorded in test 14.0.	211-A modulation jacks	Ballantine 310A	6 ±2 db less than db indication recorded in test 14.0.		Observe db indication on meter. Adjust 211-A MOD LEVEL control clockwise until Ballantine 310A indicates same vac figure recorded in test 14.0.				211-A modulation jacks	Ballantine 310A	6 ±2 db less than db indication recorded in test 14.0.	
14.2				PHASE ANGLE SELECTOR to 0 degree then per procedure.		Remove 400-Hz power from test jig.					Position AC INPUT POWER switch off (down).			MON LOGIC	CRO	Ballantine 310A	Meter indicates 0 volt.	
						Observe meter and adjust 479S-3 PHASE ANGLE SELECTOR above 0 degree until result is obtained.	Test connector adapter unit J16 and grd	Ballantine 310A	Meter indicates 0 volt.		Observe meter and adjust 479S-3 PHASE ANGLE SELECTOR above 0 degree until result is obtained.							
						Observe dial.	PHASE ANGLE SELECTOR dial	479S-3	1 ±0.5 degree.		Observe dial.				PHASE ANGLE SELECTOR dial.	479S-3	1 ±0.5 degree.	
14.3						Observe meter and adjust 479S-3 PHASE ANGLE SELECTOR below 0 degree until result is obtained.	Test connector adapter unit J16 and grd	Ballantine 310A	Meter indicates 0 volt.		Observe meter and adjust 479S-3 PHASE ANGLE SELECTOR below 0 degree until result is obtained.			MON LOGIC	CRO	Ballantine 310A	Meter indicates 0 volt.	
											Observe dial.				PHASE ANGLE SELECTOR dial.	479S-3	359 ±0.5 degrees.	
						Observe dial.	PHASE ANGLE SELECTOR dial	479S-3	359 ±0.5 degrees.		Position AC INPUT POWER switch to on.							
						Reapply 400-Hz power to test jig.					Position MODE switch to ILS.							

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Figure 507

TEST		TEST EQUIPMENT USED IN PROCEDURE 1 AND PROCEDURE 2			PROCEDURE 1 USING STANDARD TEST EQUIPMENT				
NO.	NAME	232-A GLIDESLOPE SIGNAL GENERATOR	211-A SIGNAL GENERATOR	479S-3 AUDIO SIGNAL GENERATOR	313N-( ) CONTROL	PROCEDURE	OUTPUT		
							TEST POINT	TEST EQUIPMENT	RESULT
15.0	Localizer centering		XTAL switch to 110.1	FUNCTION SELECTOR to TONE LOC.	110.10 MHz	Adjust 211-A FREQUENCY control around 110.10 MHz for maximum indication on RF MONITOR meter. Adjust 211-A RF LEVEL control for red line indication on RF MONITOR meter.			
15.1						Observe meter.	Test jig J7	HP-425A	0 ±3 ua.

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Figure 507

PROCEDURE 2 USING 977A-1 TEST PANEL								COMMENTS FOR PROCEDURE 1 AND PROCEDURE 2
FREQUENCY	PROCEDURE	OUTPUT						
		DC VOLTAGE	AC VOLTS	CRO	TEST POINT	TEST EQUIPMENT	RESULT	
110.10 MHz	Adjust 211-A FREQUENCY control around 110.10 MHz for maximum indication on RF MONITOR meter. Adjust 211-A RF LEVEL control for red line indication on RF MONITOR meter.							479S-3 90- and 150-Hz tone calibration per paragraph 2.D(4). 211-A modulation calibration per paragraph 2.D(3).
	Observe meter.	VL DEV DIF			DC VM	HP-425A	0 ±3 ua.	

TEST		TEST EQUIPMENT USED IN PROCEDURE 1 AND PROCEDURE 2			PROCEDURE 1 USING STANDARD TEST EQUIPMENT				
NO.	NAME	232-A GLIDESLOPE SIGNAL GENERATOR	211-A SIGNAL GENERATOR	479S-3 AUDIO SIGNAL GENERATOR	313N-( ) CONTROL	PROCEDURE	OUTPUT		
							TEST POINT	TEST EQUIPMENT	RESULT
16.0	Localizer flag					Observe meter.	Test jig J6	HP-425A	300 to 510 ua.

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Figure 507

TEST		TEST EQUIPMENT USED IN PROCEDURE 1 AND PROCEDURE 2			PROCEDURE 1 USING STANDARD TEST EQUIPMENT					PROCEDURE 2 USING 977A-1 TEST PANEL								COMMENTS FOR PROCEDURE 1 AND PROCEDURE 2
							OUTPUT					OUTPUT						
NO.	NAME	232-A GLIDESLOPE SIGNAL GENERATOR	211-A SIGNAL GENERATOR	479S-3 AUDIO SIGNAL GENERATOR	313N-( ) CONTROL	PROCEDURE	TEST POINT	TEST EQUIPMENT	RESULT	FREQUENCY	PROCEDURE	DC VOLTAGE	AC VOLTS	CRO	TEST POINT	TEST EQUIPMENT	RESULT	
15.0	Localizer centering		XTAL switch to 110.1	FUNCTION SELECTOR to TONE LOC.	110.10 MHz	Adjust 211-A FREQUENCY control around 110.10 MHz for maximum indication on RF MONITOR meter. Adjust 211-A RF LEVEL control for red line indication on RF MONITOR meter.				110.10 MHz	Adjust 211-A FREQUENCY control around 110.10 MHz for maximum indication on RF MONITOR meter. Adjust 211-A RF LEVEL control for red line indication on RF MONITOR meter.							479S-3 90- and 150-Hz tone calibration per paragraph 2.D(4). 211-A modulation calibration per paragraph 2.D(3).
15.1						Observe meter.	Test jig J7	HP-425A	0 ±3 ua.		Observe meter.	VL DEV DIF			DC VM	HP-425A	0 ±3 ua.	

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Figure 507

TEST		TEST EQUIPMENT USED IN PROCEDURE 1 AND PROCEDURE 2			PROCEDURE 1 USING STANDARD TEST EQUIPMENT				
NO.	NAME	232-A GLIDESLOPE SIGNAL GENERATOR	211-A SIGNAL GENERATOR	479S-3 AUDIO SIGNAL GENERATOR	313N-( ) CONTROL	PROCEDURE	OUTPUT		
							TEST POINT	TEST EQUIPMENT	RESULT
16.0	Localizer flag					Observe meter.	Test jig J6	HP-425A	300 to 510 ua.

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Figure 507

PROCEDURE 2 USING 977A-1 TEST PANEL								COMMENTS FOR PROCEDURE 1 AND PROCEDURE 2
FREQUENCY	PROCEDURE	OUTPUT						
		DC VOLTAGE	AC VOLTS	CRO	TEST POINT	TEST EQUIPMENT	RESULT	
	Observe meter.	VL FLAG			DC VM	HP-425A	300 to 510 ua.	

TEST		TEST EQUIPMENT USED IN PROCEDURE 1 AND PROCEDURE 2			PROCEDURE 1 USING STANDARD TEST				
NO.	NAME	232-A GLIDESLOPE SIGNAL GENERATOR	211-A SIGNAL GENERATOR	479S-3 AUDIO SIGNAL GENERATOR	313N-( ) CONTROL	PROCEDURE	OUTPUT		
							TEST POINT	TEST EQUIPMENT	RESULT
17.0	Localizer deviation sensitivity			TONE LOCALIZER switch to 4DB (right or left).		Observe meter.	Test jig J7	HP-425A	90 ±5 ua.

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Figure 507

TEST		TEST EQUIPMENT USED IN PROCEDURE 1 AND PROCEDURE 2			PROCEDURE 1 USING STANDARD TEST EQUIPMENT					PROCEDURE 2 USING 977A-1 TEST PANEL								COMMENTS FOR PROCEDURE 1 AND PROCEDURE 2
NO.	NAME	232-A GLIDESLOPE SIGNAL GENERATOR	211-A SIGNAL GENERATOR	479S-3 AUDIO SIGNAL GENERATOR	313N-( ) CONTROL	PROCEDURE	OUTPUT			FREQUENCY	PROCEDURE	OUTPUT						
							TEST POINT	TEST EQUIPMENT	RESULT			DC VOLTAGE	AC VOLTS	CRO	TEST POINT	TEST EQUIPMENT	RESULT	
16.0	Localizer flag					Observe meter.	Test jig J6	HP-425A	300 to 510 ua.		Observe meter.	VL FLAG			DC VM	HP-425A	300 to 510 ua.	

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Figure 507

TEST		TEST EQUIPMENT USED IN PROCEDURE 1 AND PROCEDURE 2			PROCEDURE 1 USING STANDARD TEST				
NO.	NAME	232-A GLIDESLOPE SIGNAL GENERATOR	211-A SIGNAL GENERATOR	479S-3 AUDIO SIGNAL GENERATOR	313N-( ) CONTROL	PROCEDURE	OUTPUT		
							TEST POINT	TEST EQUIPMENT	RESULT
17.0	Localizer deviation sensitivity			TONE LOCALIZER switch to 4DB (right or left).		Observe meter.	Test jig J7	HP-425A	90 ±5 ua.

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Figure 507

PROCEDURE 2 USING 977A-1 TEST PANEL								COMMENTS FOR PROCEDURE 1 AND PROCEDURE 2
FREQUENCY	PROCEDURE	OUTPUT						
		DC VOLTAGE	AC VOLTS	CRO	TEST POINT	TEST EQUIPMENT	RESULT	
	Observe meter.	VL DEV DIF			DC VM	HP-425A	90 ±5 ua.	

TEST		TEST EQUIPMENT USED IN PROCEDURE 1 AND PROCEDURE 2			PROCEDURE 1 USING STANDARD TEST EQUIPMENT				
NO.	NAME	232-A GLIDESLOPE SIGNAL GENERATOR	211-A SIGNAL GENERATOR	479S-3 AUDIO SIGNAL GENERATOR	313N-( ) CONTROL	PROCEDURE	OUTPUT		
							TEST POINT	TEST EQUIPMENT	RESULT
18.0	RMI pointer bias					Observe pointer. (Pointer bias circuit not removed.)	Test jig	RMI	Pointer to right wing position.

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Figure 507

TEST		TEST EQUIPMENT USED IN PROCEDURE 1 AND PROCEDURE 2			PROCEDURE 1 USING STANDARD TEST					PROCEDURE 2 USING 977A-1 TEST PANEL								COMMENTS FOR PROCEDURE 1 AND PROCEDURE 2
NO.	NAME	232-A GLIDESLOPE SIGNAL GENERATOR	211-A SIGNAL GENERATOR	479S-3 AUDIO SIGNAL GENERATOR	313N-( ) CONTROL	PROCEDURE	OUTPUT			FREQUENCY	PROCEDURE	OUTPUT						
							TEST POINT	TEST EQUIPMENT	RESULT			DC VOLTAGE	AC VOLTS	CRO	TEST POINT	TEST EQUIPMENT	RESULT	
17.0	Localizer deviation sensitivity			TONE LOCALIZER switch to 4DB (right or left).		Observe meter.	Test jig J7	HP-425A	90 ±5 ua.		Observe meter.	VL DEV DIF			DC VM	HP-425A	90 ±5 ua.	

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Figure 507

TEST		TEST EQUIPMENT USED IN PROCEDURE 1 AND PROCEDURE 2			PROCEDURE 1 USING STANDARD TEST EQUIPMENT				
NO.	NAME	232-A GLIDESLOPE SIGNAL GENERATOR	211-A SIGNAL GENERATOR	479S-3 AUDIO SIGNAL GENERATOR	313N-( ) CONTROL	PROCEDURE	OUTPUT		
							TEST POINT	TEST EQUIPMENT	RESULT
18.0	RMI pointer bias					Observe pointer. (Pointer bias circuit not removed.)	Test jig	RMI	Pointer to right wing position.

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Figure 507

PROCEDURE 2 USING 977A-1 TEST PANEL								COMMENTS FOR PROCEDURE 1 AND PROCEDURE 2
FREQUENCY	PROCEDURE	OUTPUT						
		DC VOLTAGE	AC VOLTS	CRO	TEST POINT	TEST EQUIPMENT	RESULT	
	Observe pointer. (Pointer bias circuit not removed.)					RMI	Pointer to right wing position.	

TEST		TEST EQUIPMENT USED IN PROCEDURE 1 AND PROCEDURE 2			PROCEDURE 1 USING STANDARD TEST EQUIPMENT				
NO.	NAME	232-A GLIDESLOPE SIGNAL GENERATOR	211-A SIGNAL GENERATOR	479S-3 AUDIO SIGNAL GENERATOR	313N-( ) CONTROL	PROCEDURE	OUTPUT		
							TEST POINT	TEST EQUIPMENT	RESULT
19.0	Localizer monitoring			TONE LOCALIZER switch to 0.		Connect Ballantine 310A to modulation jacks on 211-A front panel. Observe meter and record db indication and vac indication.	211-A modulation jacks	Ballantine 310A	Recorded.
19.1		Adjust MOD LEVEL control per procedure				Observe test jig HI POWER VOR/LOC FLAG light and slowly adjust 211-A MOD LEVEL control counterclockwise until light just goes off. Observe db indication on meter. Adjust 211-A MOD LEVEL control clockwise until Ballantine 310A indicates same vac figure recorded in test 19.0.	211-A modulation jacks	Ballantine 310A	2 ±1 db less than db indication recorded in test 19.0.
19.2						Install a shorting phone plug (tip and sleeve jumpered) in test jig J7.			
19.3				TONE LOCALIZER switch to .5 DB (to the right).		Observe indicator.	Test jig HI POWER VOR/LOC FLAG light		Light is off.
19.4				TONE LOCALIZER switch to .5 DB (to the left).		Observe indicator. Remove shorting plug from J7.	Test jig HI POWER VOR/LOC FLAG light		Light is off.

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Figure 507

TEST		TEST EQUIPMENT USED IN PROCEDURE 1 AND PROCEDURE 2			PROCEDURE 1 USING STANDARD TEST EQUIPMENT					PROCEDURE 2 USING 977A-1 TEST PANEL								COMMENTS FOR PROCEDURE 1 AND PROCEDURE 2
							OUTPUT					OUTPUT						
NO.	NAME	232-A GLIDESLOPE SIGNAL GENERATOR	211-A SIGNAL GENERATOR	479S-3 AUDIO SIGNAL GENERATOR	313N-( ) CONTROL	PROCEDURE	TEST POINT	TEST EQUIPMENT	RESULT	FREQUENCY	PROCEDURE	DC VOLTAGE	AC VOLTS	CRO	TEST POINT	TEST EQUIPMENT	RESULT	
18.0	RMI pointer bias					Observe pointer. (Pointer bias circuit not removed.)	Test jig	RMI	Pointer to right wing position.		Observe pointer. (Pointer bias circuit not removed.)					RMI	Pointer to right wing position.	

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Figure 507

TEST		TEST EQUIPMENT USED IN PROCEDURE 1 AND PROCEDURE 2			PROCEDURE 1 USING STANDARD TEST EQUIPMENT				
							OUTPUT		
NO.	NAME	232-A GLIDESLOPE SIGNAL GENERATOR	211-A SIGNAL GENERATOR	479S-3 AUDIO SIGNAL GENERATOR	313N-( ) CONTROL	PROCEDURE	TEST POINT	TEST EQUIPMENT	RESULT
19.0	Localizer monitoring			TONE LOCALIZER switch to 0.		Connect Ballantine 310A to modulation jacks on 211-A front panel. Observe meter and record db indication and vac indication.	211-A modulation jacks	Ballantine 310A	Recorded.
19.1		Adjust MOD LEVEL control per procedure				Observe test jig HI POWER VOR/LOC FLAG light and slowly adjust 211-A MOD LEVEL control counterclockwise until light just goes off. Observe db indication on meter. Adjust 211-A MOD LEVEL control clockwise until Ballantine 310A indicates same vac figure recorded in test 19.0.	211-A modulation jacks	Ballantine 310A	2 ±1 db less than db indication recorded in test 19.0.
19.2						Install a shorting phone plug (tip and sleeve jumpered) in test jig J7.			
19.3				TONE LOCALIZER switch to .5 DB (to the right).		Observe indicator.	Test jig HI POWER VOR/LOC FLAG light		Light is off.
19.4				TONE LOCALIZER switch to .5 DB (to the left).		Observe indicator. Remove shorting plug from J7.	Test jig HI POWER VOR/LOC FLAG light		Light is off.

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Figure 507

PROCEDURE 2 USING 977A-1 TEST PANEL								COMMENTS FOR PROCEDURE 1 AND PROCEDURE 2
FREQUENCY	PROCEDURE	OUTPUT						
		DC VOLTAGE	AC VOLTS	CRO	TEST POINT	TEST EQUIPMENT	RESULT	
	Connect Ballantine 310A to modulation jacks on 211-A front panel. Observe meter and record db indication and vac indication.				211-A modulation jacks	Ballantine 310A	Recorded.	
	Observe 977A-1 VL POWER FLAG light and slowly adjust 211-A MOD LEVEL control counterclockwise until light just goes off. Observe db indication on meter. Adjust 211-A MOD LEVEL control clockwise until Ballantine 310A indicates same vac figure recorded in test 19.0.				211-A modulation jacks	Ballantine 310A	2 ±1 db less than db indication recorded in test 19.0.	
	Position DC VOLTAGE switch S3 to VL DEV PRI. Install a shorting plug across 977A-1 ALT DC VM jacks.							
	Observe indicator.				VL POWER FLAG light		Light is off.	
	Observe indicator. Remove shorting plug from ALT DC VM jacks.				VL POWER FLAG light		Light is off.	

TEST		TEST EQUIPMENT USED IN PROCEDURE 1 AND PROCEDURE 2			PROCEDURE 1 USING STANDARD TEST EQUIPMENT				
NO.	NAME	232-A GLIDESLOPE SIGNAL GENERATOR	211-A SIGNAL GENERATOR	479S-3 AUDIO SIGNAL GENERATOR	313N-( ) CONTROL	PROCEDURE	OUTPUT		
							TEST POINT	TEST EQUIPMENT	RESULT
20.0	Glideslope sensitivity	Adjust OUTPUT LEVEL control per procedure.		TONE LOCALIZER switch to 0.		Observe meter and adjust 232-A OUTPUT LEVEL control counterclockwise until result is obtained.	Test jig J5	HP-425A	47 ua.
						Observe dial indication.	OUTPUT LEVEL dial	232-A	Less than 10 u
20.1		In turn, adjust FREQUENCY control to: 334.70 MHz 334.10 MHz 330.50 MHz 335.00 MHz 330.80 MHz 333.50 MHz 331.10 MHz (corresponds to 313N-( ) or 977A-1 frequencies in the order shown).			108.10 MHz 108.30 MHz 108.70 MHz 110.30 MHz 110.90 MHz 111.70 MHz 111.90 MHz	Repeat test 20.0 for each listed frequency. Readjust 232-A CARRIER ADJUST control for red line indication on CARRIER MONITOR meter for each frequency change.	Same as test 20.0	Same as test 20.0	Same as test 20.0.

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Figure 507

TEST		TEST EQUIPMENT USED IN PROCEDURE 1 AND PROCEDURE 2			PROCEDURE 1 USING STANDARD TEST EQUIPMENT					PROCEDURE 2 USING 977A-1 TEST PANEL								COMMENTS FOR PROCEDURE 1 AND PROCEDURE 2
							OUTPUT					OUTPUT						
NO.	NAME	232-A GLIDESLOPE SIGNAL GENERATOR	211-A SIGNAL GENERATOR	479S-3 AUDIO SIGNAL GENERATOR	313N-( ) CONTROL	PROCEDURE	TEST POINT	TEST EQUIPMENT	RESULT	FREQUENCY	PROCEDURE	DC VOLTAGE	AC VOLTS	CRO	TEST POINT	TEST EQUIPMENT	RESULT	
19.0	Localizer monitoring			TONE LOCALIZER switch to 0.		Connect Ballantine 310A to modulation jacks on 211-A front panel. Observe meter and record db indication and vac indication.	211-A modulation jacks	Ballantine 310A	Recorded.		Connect Ballantine 310A to modulation jacks on 211-A front panel. Observe meter and record db indication and vac indication.				211-A modulation jacks	Ballantine 310A	Recorded.	
19.1		Adjust MOD LEVEL control per procedure				Observe test jig HI POWER VOR/LOC FLAG light and slowly adjust 211-A MOD LEVEL control counterclockwise until light just goes off. Observe db indication on meter. Adjust 211-A MOD LEVEL control clockwise until Ballantine 310A indicates same vac figure recorded in test 19.0.	211-A modulation jacks	Ballantine 310A	2 ±1 db less than db indication recorded in test 19.0.		Observe 977A-1 VL POWER FLAG light and slowly adjust 211-A MOD LEVEL control counterclockwise until light just goes off. Observe db indication on meter. Adjust 211-A MOD LEVEL control clockwise until Ballantine 310A indicates same vac figure recorded in test 19.0.				211-A modulation jacks	Ballantine 310A	2 ±1 db less than db indication recorded in test 19.0.	
19.2						Install a shorting phone plug (tip and sleeve jumpered) in test jig J7.					Position DC VOLTAGE switch S3 to VL DEV PRI. Install a shorting plug across 977A-1 ALT DC VM jacks.							
19.3				TONE LOCALIZER switch to .5 DB (to the right).		Observe indicator.	Test jig HI POWER VOR/LOC FLAG light		Light is off.		Observe indicator.				VL POWER FLAG light		Light is off.	
19.4				TONE LOCALIZER switch to .5 DB (to the left).		Observe indicator. Remove shorting plug from J7.	Test jig HI POWER VOR/LOC FLAG light		Light is off.		Observe indicator. Remove shorting plug from ALT DC VM jacks.				VL POWER FLAG light		Light is off.	

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Figure 507

TEST		TEST EQUIPMENT USED IN PROCEDURE 1 AND PROCEDURE 2			PROCEDURE 1 USING STANDARD TEST EQUIPMENT				
NO.	NAME	232-A GLIDESLOPE SIGNAL GENERATOR	211-A SIGNAL GENERATOR	479S-3 AUDIO SIGNAL GENERATOR	313N-( ) CONTROL	PROCEDURE	OUTPUT		
							TEST POINT	TEST EQUIPMENT	RESULT
20.0	Glideslope sensitivity	Adjust OUTPUT LEVEL control per procedure.		TONE LOCALIZER switch to 0.		Observe meter and adjust 232-A OUTPUT LEVEL control counterclockwise until result is obtained.	Test jig J5	HP-425A	47 ua.
						Observe dial indication.	OUTPUT LEVEL dial	232-A	Less than 10 u
20.1		In turn, adjust FREQUENCY control to: 334.70 MHz 334.10 MHz 330.50 MHz 335.00 MHz 330.80 MHz 333.50 MHz 331.10 MHz (corresponds to 313N-( ) or 977A-1 frequencies in the order shown).			108.10 MHz 108.30 MHz 108.70 MHz 110.30 MHz 110.90 MHz 111.70 MHz 111.90 MHz	Repeat test 20.0 for each listed frequency. Readjust 232-A CARRIER ADJUST control for red line indication on CARRIER MONITOR meter for each frequency change.	Same as test 20.0	Same as test 20.0	Same as test 20.0.

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Figure 507

PROCEDURE 2 USING 977A-1 TEST PANEL								COMMENTS FOR PROCEDURE 1 AND PROCEDURE 2
FREQUENCY	PROCEDURE	OUTPUT						
		DC VOLTAGE	AC VOLTS	CRO	TEST POINT	TEST EQUIPMENT	RESULT	
	Observe meter and adjust 232-A OUTPUT LEVEL control counter-clockwise until result is obtained.	GS DEV DIF			DC VM	HP-425A	47 ua.	
	Observe dial indication.				OUT-PUT LEVEL dial	232-A	Less than 10 uv.	
108.10 MHz 108.30 MHz 108.70 MHz 110.30 MHz 110.90 MHz 111.70 MHz 111.90 MHz	Repeat test 20.0 for each listed frequency. Readjust 232-A CARRIER ADJUST control for red line indication on CARRIER MONITOR meter for each frequency change.	GS DEV DIF			Same as test 20.0	Same as test 20.0	Same as test 20.0.	

TEST		TEST EQUIPMENT USED IN PROCEDURE 1 AND PROCEDURE 2			PROCEDURE 1 USING STANDARD TEST EQUIPMENT				
NO	NAME	232-A GLIDESLOPE SIGNAL GENERATOR	211-A SIGNAL GENERATOR	479S-3 AUDIO SIGNAL GENERATOR	313N-( ) CONTROL	PROCEDURE	OUTPUT		
							TEST POINT	TEST EQUIPMENT	RESULT
21.0	Glideslope deviation sensitivity	FREQUENCY switch to 332.0 MC. OUTPUT LEVEL control to 700 uv. DB TONE RATIO switch to 2.0 (right or left).			109.30 MHz	Observe meter.	Test jig J5	HP-425A	78 ±5 ua.

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Figure 507

TEST		TEST EQUIPMENT USED IN PROCEDURE 1 AND PROCEDURE 2			PROCEDURE 1 USING STANDARD TEST EQUIPMENT					PROCEDURE 2 USING 977A-1 TEST PANEL								COMMENTS FOR PROCEDURE 1 AND PROCEDURE 2
							OUTPUT					OUTPUT						
NO.	NAME	232-A GLIDESLOPE SIGNAL GENERATOR	211-A SIGNAL GENERATOR	479S-3 AUDIO SIGNAL GENERATOR	313N-( ) CONTROL	PROCEDURE	TEST POINT	TEST EQUIPMENT	RESULT	FREQUENCY	PROCEDURE	DC VOLTAGE	AC VOLTS	CRO	TEST POINT	TEST EQUIPMENT	RESULT	
20.0	Glideslope sensitivity	Adjust OUTPUT LEVEL control per procedure.		TONE LOCALIZER switch to 0.		Observe meter and adjust 232-A OUTPUT LEVEL control counterclockwise until result is obtained.	Test jig J5	HP-425A	47 ua.		Observe meter and adjust 232-A OUTPUT LEVEL control counter-clockwise until result is obtained.	GS DEV DIF			DC VM	HP-425A	47 ua.	
						Observe dial indication.	OUTPUT LEVEL dial	232-A	Less than 10 uv.		Observe dial indication.				OUT-PUT LEVEL dial	232-A	Less than 10 uv.	
20.1		In turn, adjust FREQUENCY control to: 334.70 MHz 334.10 MHz 330.50 MHz 335.00 MHz 330.80 MHz 333.50 MHz 331.10 MHz (corresponds to 313N-( ) or 977A-1 frequencies in the order shown).			108.10 MHz 108.30 MHz 108.70 MHz 110.30 MHz 110.90 MHz 111.70 MHz 111.90 MHz	Repeat test 20.0 for each listed frequency. Readjust 232-A CARRIER ADJUST control for red line indication on CARRIER MONITOR meter for each frequency change.	Same as test 20.0	Same as test 20.0	Same as test 20.0.	108.10 MHz 108.30 MHz 108.70 MHz 110.30 MHz 110.90 MHz 111.70 MHz 111.90 MHz	Repeat test 20.0 for each listed frequency. Readjust 232-A CARRIER ADJUST control for red line indication on CARRIER MONITOR meter for each frequency change.	GS DEV DIF			Same as test 20.0	Same as test 20.0	Same as test 20.0.	

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Figure 507

TEST		TEST EQUIPMENT USED IN PROCEDURE 1 AND PROCEDURE 2			PROCEDURE 1 USING STANDARD TEST EQUIPMENT				
NO	NAME	232-A GLIDESLOPE SIGNAL GENERATOR	211-A SIGNAL GENERATOR	479S-3 AUDIO SIGNAL GENERATOR	313N-( ) CONTROL	PROCEDURE	OUTPUT		
							TEST POINT	TEST EQUIPMENT	RESULT
21.0	Glideslope deviation sensitivity	FREQUENCY switch to 332.0 MC. OUTPUT LEVEL control to 700 uv. DB TONE RATIO switch to 2.0 (right or left).			109.30 MHz	Observe meter.	Test jig J5	HP-425A	78 ±5 ua.

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Figure 507

PROCEDURE 2 USING 977A-1 TEST PANEL								COMMENTS FOR PROCEDURE 1 AND PROCEDURE 2
FREQUENCY	PROCEDURE	OUTPUT						
		DC VOLTAGE	AC VOLTS	CRO	TEST POINT	TEST EQUIPMENT	RESULT	
109.30 MHz	Observe meter.	GS DEV DIF			DC VM	HP-425A	78 ±5 ua.	

TEST		TEST EQUIPMENT USED IN PROCEDURE 1 AND PROCEDURE 2			PROCEDURE 1 USING STANDARD TEST EQUIPMENT				
NO	NAME	232-A GLIDESLOPE SIGNAL GENERATOR	211-A SIGNAL GENERATOR	479S-3 AUDIO SIGNAL GENERATOR	313N-( ) CONTROL	PROCEDURE	OUTPUT		
							TEST POINT	TEST EQUIPMENT	RESULT
22.0	Glideslope balance and flag sensitivity	DB TONE RATIO switch to 0.				Observe meter (deviation).	Test jig J5	HP-425A	0 ±3 ua.
						Observe meter (flag).	Test jig J6	HP-425A	300 to 510 ua.

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Figure 507

TEST		TEST EQUIPMENT USED IN PROCEDURE 1 AND PROCEDURE 2			PROCEDURE 1 USING STANDARD TEST EQUIPMENT					PROCEDURE 2 USING 977A-1 TEST PANEL								COMMENTS FOR PROCEDURE 1 AND PROCEDURE 2
NO	NAME	232-A GLIDESLOPE SIGNAL GENERATOR	211-A SIGNAL GENERATOR	479S-3 AUDIO SIGNAL GENERATOR	313N-( ) CONTROL	PROCEDURE	OUTPUT			FREQUENCY	PROCEDURE	OUTPUT						
							TEST POINT	TEST EQUIPMENT	RESULT			DC VOLTAGE	AC VOLTS	CRO	TEST POINT	TEST EQUIPMENT	RESULT	
21.0	Glideslope deviation sensitivity	FREQUENCY switch to 332.0 MC. OUTPUT LEVEL control to 700 uv. DB TONE RATIO switch to 2.0 (right or left).			109.30 MHz	Observe meter.	Test jig J5	HP-425A	78 ±5 ua.	109.30 MHz	Observe meter.	GS DEV DIF			DC VM	HP-425A	78 ±5 ua.	

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Figure 507

TEST		TEST EQUIPMENT USED IN PROCEDURE 1 AND PROCEDURE 2			PROCEDURE 1 USING STANDARD TEST EQUIPMENT				
NO	NAME	232-A GLIDESLOPE SIGNAL GENERATOR	211-A SIGNAL GENERATOR	479S-3 AUDIO SIGNAL GENERATOR	313N-( ) CONTROL	PROCEDURE	OUTPUT		
							TEST POINT	TEST EQUIPMENT	RESULT
22.0	Glideslope balance and flag sensitivity	DB TONE RATIO switch to 0.				Observe meter (deviation). Observe meter (flag).	Test jig J5 Test jig J6	HP-425A HP-425A	0 ±3 ua. 300 to 510 ua.

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Figure 507

PROCEDURE 2 USING 977A-1 TEST PANEL								COMMENTS FOR PROCEUDRE 1 AND PROCEDURE 2
FREQUENCY	PROCEDURE	OUTPUT						
		DC VOLTAGE	AC VOLTS	CRO	TEST POINT	TEST EQUIPMENT	RESULT	
	Observe meter.	GS DEV DIF			DC VM	HP-425A	0 ±3 ua.	
	Observe meter.	GS FLAG			DC VM	HP-425A	300 to 510 ua.	

TEST		TEST EQUIPMENT USED IN PROCEDURE 1 AND PROCEDURE 2			PROCEDURE 1 USING STANDARD TEST EQUIPMENT				
NO	NAME	232-A GLIDESLOPE SIGNAL GENERATOR	211-A SIGNAL GENERATOR	479S-3 AUDIO SIGNAL GENERATOR	313N-( ) CONTROL	PROCEDURE	OUTPUT		
							TEST POINT	TEST EQUIPMENT	RESULT
23.0	Glideslope monitoring					Connect Ballantine 310A to 232-A METER CALIB jacks (located behind access door on front panel). Observe meter and record db indication and vac indication.	232-A METER CALIB jacks	Ballantine 310A	Recorded.
23.1		Adjust MOD LEVEL control per procedure.				Observe test jig HI POWER GLIDESLOPE FLAG light and slowly adjust 232-A MODE LEVEL control counter-clockwise until light just goes off. Observe db indication on meter. Adjust 232-A MOD LEVEL control clockwise until Ballantine 310A indicates same vac figure recorded in test 23.0.	232-A METER CALIB jacks	Ballantine	2 ±1 db less than db indication recorded in test 23.0.
23.2						Place a 120-ohm ±10 percent resistor across the sleeve and tip connections of a phone plug. Install the phone plug in test jig J5.			
23.3		DB TONE RATIO switch to 0.5 to the right.				Observe indication.	Test jig HI POWER GLIDESLOPE FLAG light		Light is off.
23.4		DB TONE RATIO switch to 0.5 to the left.				Observe indicator.	Test jig HI POWER GLIDESLOPE FLAG light		Light is off.

51RV-2B VOR/ILS Receiver, Preinstallation Test Procedures (Sheet 23 of 25)
Figure 507

TEST		TEST EQUIPMENT USED IN PROCEDURE 1 AND PROCEDURE 2			PROCEDURE 1 USING STANDARD TEST EQUIPMENT					PROCEDURE 2 USING 977A-1 TEST PANEL								COMMENTS FOR PROCEUDRE 1 AND PROCEDURE 2
NO	NAME	232-A GLIDESLOPE SIGNAL GENERATOR	211-A SIGNAL GENERATOR	479S-3 AUDIO SIGNAL GENERATOR	313N-( ) CONTROL	PROCEDURE	OUTPUT			FREQUENCY	PROCEDURE	OUTPUT						
							TEST POINT	TEST EQUIPMENT	RESULT			DC VOLTAGE	AC VOLTS	CRO	TEST POINT	TEST EQUIPMENT	RESULT	
22.0	Glideslope balance and flag sensitivity	DB TONE RATIO switch to 0.				Observe meter (deviation).	Test jig J5	HP-425A	0 ±3 ua.		Observe meter.	GS DEV DIF			DC VM	HP-425A	0 ±3 ua.	
						Observe meter (flag).	Test jig J6	HP-425A	300 to 510 ua.		Observe meter.	GS FLAG			DC VM	HP-425A	300 to 510 ua.	

51RV-2B VOR/ILS Receiver, Preinstallation Test Procedures (Sheet 22 of 25)
Figure 507

TEST		TEST EQUIPMENT USED IN PROCEDURE 1 AND PROCEDURE 2			PROCEDURE 1 USING STANDARD TEST EQUIPMENT				
NO	NAME	232-A GLIDESLOPE SIGNAL GENERATOR	211-A SIGNAL GENERATOR	479S-3 AUDIO SIGNAL GENERATOR	313N-( ) CONTROL	PROCEDURE	OUTPUT		
							TEST POINT	TEST EQUIPMENT	RESULT
23.0	Glideslope monitoring					Connect Ballantine 310A to 232-A METER CALIB jacks (located behind access door on front panel). Observe meter and record db indication and vac indication.	232-A METER CALIB jacks	Ballantine 310A	Recorded.
23.1		Adjust MOD LEVEL control per procedure.				Observe test jig HI POWER GLIDESLOPE FLAG light and slowly adjust 232-A MODE LEVEL control counterclockwise until light just goes off. Observe db indication on meter. Adjust 232-A MOD LEVEL control clockwise until Ballantine 310A indicates same vac figure recorded in test 23.0.	232-A METER CALIB jacks	Ballantine	2 ±1 db less than db indication recorded in test 23.0.
23.2						Place a 120-ohm ±10 percent resistor across the sleeve and tip connections of a phone plug. Install the phone plug in test jig J5.			
23.3		DB TONE RATIO switch to 0.5 to the right.				Observe indication.	Test jig HI POWER GLIDESLOPE FLAG light		Light is off.
23.4		DB TONE RATIO switch to 0.5 to the left.				Observe indicator.	Test jig HI POWER GLIDESLOPE FLAG light		Light is off.

51RV-2B VOR/ILS Receiver, Preinstallation Test Procedures (Sheet 23 of 25)
Figure 507

PROCEDURE 2 USING 977A-1 TEST PANEL								COMMENTS FOR PROCEDURE 1 AND PROCEDURE 2
FREQUENCY	PROCEDURE	OUTPUT						
		DC VOLTAGE	AC VOLTS	CRO	TEST POINT	TEST EQUIPMENT	RESULT	
	Connect Ballantine 310A to 232-A METER CALIB jacks (located behind access door on front panel). Observe meter and record db indication and vac indication.				232-A METER CALIB jacks	Ballantine 310A	Recorded.	
	Observe 977A-1 GS POWER FLAG light and slowly adjust 232-A MOD LEVEL control counterclockwise until light just goes off. Observe db indication on meter. Adjust 232-A MOD LEVEL control clockwise until Ballantine 310A indicates same vac figure recorded in test 23.0.				232-A METER CALIB jacks	Ballantine 310A	2 ±1 db less than db indication recorded in test 23.0.	
	Position DC VOLTAGE switch S3 to GS DEV PRI. Install a 120-ohm ±10 percent resistor across 977A-1 ALT DC VM jacks.							
	Observe indicator.				GS POWER FLAG light		Light is off.	
	Observe indicator. Remove resistor from ALT DC VM jacks.				GS POWER FLAG light		Light is off.	

TEST		TEST EQUIPMENT USED IN PROCEDURE 1 AND PROCEDURE 2			PROCEDURE 1 USING STANDARD TEST EQUIPMENT				
NO	NAME	232-A GLIDESLOPE SIGNAL GENERATOR	211-A SIGNAL GENERATOR	479S-3 AUDIO SIGNAL GENERATOR	313N-( ) CONTROL	PROCEDURE	OUTPUT		
							TEST POINT	TEST EQUIPMENT	RESULT
24.0	ILS self-test				110.10 MHz	Actuate UP/L test switch on 51RV-2B front panel. Observe meter. Release UP/L test switch.	 Test jig J5 Test jig J7	 HP-425A HP-425A	 75 ±5 ua. 75 ±5 ua.
24.1						Actuate DN/R test switch on 51RV-2B front panel. Observe meter. Observe meter. Release DN/R test switch.	 Test jig J7 Test jig J5	 HP-425A HP-425A	 75 ±5 ua. 75 ±5 ua.

51RV-2B VOR/ILS Receiver, Preinstallation Test Procedures (Sheet 24 of 25)
Figure 507

TEST		TEST EQUIPMENT USED IN PROCEDURE 1 AND PROCEDURE 2			PROCEDURE 1 USING STANDARD TEST EQUIPMENT					PROCEDURE 2 USING 977A-1 TEST PANEL								COMMENTS FOR PROCEDURE 1 AND PROCEDURE 2
							OUTPUT					OUTPUT						
NO	NAME	232-A GLIDESLOPE SIGNAL GENERATOR	211-A SIGNAL GENERATOR	479S-3 AUDIO SIGNAL GENERATOR	313N-( ) CONTROL	PROCEDURE	TEST POINT	TEST EQUIPMENT	RESULT	FREQUENCY	PROCEDURE	DC VOLTAGE	AC VOLTS	CRO	TEST POINT	TEST EQUIPMENT	RESULT	
23.0	Glideslope monitoring					Connect Ballantine 310A to 232-A METER CALIB jacks (located behind access door on front panel). Observe meter and record db indication and vac indication.	232-A METER CALIB jacks	Ballantine 310A	Recorded.		Connect Ballantine 310A to 232-A METER CALIB jacks (located behind access door on front panel). Observe meter and record db indication and vac indication.				232-A METER CALIB jacks	Ballantine 310A	Recorded.	
23.1		Adjust MOD LEVEL control per procedure.				Observe test jig HI POWER GLIDESLOPE FLAG light and slowly adjust 232-A MODE LEVEL control counterclockwise until light just goes off. Observe db indication on meter. Adjust 232-A MOD LEVEL control clockwise until Ballantine 310A indicates same vac figure recorded in test 23.0.	232-A METER CALIB jacks	Ballantine	2 ±1 db less than db indication recorded in test 23.0.		Observe 977A-1 GS POWER FLAG light and slowly adjust 232-A MOD LEVEL control counterclockwise until light just goes off. Observe db indication on meter. Adjust 232-A MOD LEVEL control clockwise until Ballantine 310A indicates same vac figure recorded in test 23.0.				232-A METER CALIB jacks	Ballantine 310A	2 ±1 db less than db indication recorded in test 23.0.	
23.2						Place a 120-ohm ±10 percent resistor across the sleeve and tip connections of a phone plug. Install the phone plug in test jig J5.					Position DC VOLTAGE switch S3 to GS DEV PRI. Install a 120-ohm ±10 percent resistor across 977A-1 ALT DC VM jacks.							
23.3		DB TONE RATIO switch to 0.5 to the right.				Observe indication.	Test jig HI POWER GLIDESLOPE FLAG light		Light is off.		Observe indicator.				GS POWER FLAG light		Light is off.	
23.4		DB TONE RATIO switch to 0.5 to the left.				Observe indicator.	Test jig HI POWER GLIDESLOPE FLAG light		Light is off.		Observe indicator. Remove resistor from ALT DC VM jacks.				GS POWER FLAG light		Light is off.	

51RV-2B VOR/ILS Receiver, Preinstallation Test Procedures (Sheet 23 of 25)
Figure 507

TEST		TEST EQUIPMENT USED IN PROCEDURE 1 AND PROCEDURE 2			PROCEDURE 1 USING STANDARD TEST EQUIPMENT				
NO	NAME	232-A GLIDESLOPE SIGNAL GENERATOR	211-A SIGNAL GENERATOR	479S-3 AUDIO SIGNAL GENERATOR	313N-( ) CONTROL	PROCEDURE	OUTPUT		
							TEST POINT	TEST EQUIPMENT	RESULT
24.0	ILS self-test				110.10 MHz	Actuate UP/L test switch on 51RV-2B front panel. Observe meter. Observe meter. Release UP/L test switch.	 Test jig J5 Test jig J7	 HP-425A HP-425A	 75 ±5 ua. 75 ±5 ua.
24.1						Actuate DN/R test switch on 51RV-2B front panel. Observe meter. Observe meter. Release DN/R test switch.	 Test jig J7 Test jig J5	 HP-425A HP-425A	 75 ±5 ua. 75 ±5 ua.

51RV-2B VOR/ILS Receiver, Preinstallation Test Procedures (Sheet 24 of 25)
Figure 507

PROCEDURE 2 USING 977A-1 TEST PANEL								COMMENTS FOR PROCEDURE 1 AND PROCEDURE 2
		OUTPUT						
FREQUENCY	PROCEDURE	DC VOLTAGE	AC VOLTS	CRO	TEST POINT	TEST EQUIPMENT	RESULT	
110.10 MHz	Actuate UP/L test switch on 51RV-2B front panel. Observe meter. Observe meter. Release UP/L test switch.	 GS DEV PRI VL DEV PRI			 DC VM DC VM	 HP-425A HP-425A	 75 ±5 ua. 75 ±5 ua.	
	Actuate DN/R test switch on 51RV-2B front panel. Observe meter. Observe meter. Release DN/R test switch.	 VL DEV PRI GS DEV PRI			 DC VM DC VM	 HP-425A HP-425A	 75 ±5 ua. 75 ±5 ua.	

TEST		TEST EQUIPMENT USED IN PROCEDURE 1 AND PROCEDURE 2			PROCEDURE 1 USING STANDARD TEST EQUIPMENT				
NO	NAME	232-A GLIDESLOPE SIGNAL GENERATOR	211-A SIGNAL GENERATOR	479S-3 AUDIO SIGNAL GENERATOR	313N-( ) CONTROL	PROCEDURE	OUTPUT		
							TEST POINT	TEST EQUIPMENT	RESULT
25.0						END OF TEST. Remove all test equipment from 51RV-2B.			

51RV-2B VOR/ILS Receiver, Preinstallation Test Procedures (Sheet 25 of 25)
Figure 507

TEST		TEST EQUIPMENT USED IN PROCEDURE 1 AND PROCEDURE 2			PROCEDURE 1 USING STANDARD TEST EQUIPMENT					PROCEDURE 2 USING 977A-1 TEST PANEL								COMMENTS FOR PROCEDURE 1 AND PROCEDURE 2
							OUTPUT					OUTPUT						
NO	NAME	232-A GLIDESLOPE SIGNAL GENERATOR	211-A SIGNAL GENERATOR	479S-3 AUDIO SIGNAL GENERATOR	313N-( ) CONTROL	PROCEDURE	TEST POINT	TEST EQUIPMENT	RESULT	FREQUENCY	PROCEDURE	DC VOLTAGE	AC VOLTS	CRO	TEST POINT	TEST EQUIPMENT	RESULT	
24.0	ILS self-test				110.10 MHz	Actuate UP/L test switch on 51RV-2B front panel. Observe meter. Observe meter. Release UP/L test switch.	 Test jig J5 Test jig J7	 HP-425A HP-425A	 75 ±5 ua. 75 ±5 ua.	110.10 MHz	Actuate UP/L test switch on 51RV-2B front panel. Observe meter. Observe meter. Release UP/L test switch.	 GS DEV PRI VL DEV PRI			 DC VM DC VM	 HP-425A HP-425A	 75 ±5 ua. 75 ±5 ua.	
24.1						Actuate DN/R test switch on 51RV-2B front panel. Observe meter. Observe meter. Release DN/R test switch.	 Test jig J7 Test jig J5	 HP-425A HP-425A	 75 ±5 ua. 75 ±5 ua.		Actuate DN/R test switch on 51RV-2B front panel. Observe meter. Observe meter. Release DN/R test switch.	 VL DEV PRI GS DEV PRI			 DC VM DC VM	 HP-425A HP-425A	 75 ±5 ua. 75 ±5 ua.	

51RV-2B VOR/ILS Receiver, Preinstallation Test Procedures (Sheet 24 of 25)
Figure 507

TEST		TEST EQUIPMENT USED IN PROCEDURE 1 AND PROCEDURE 2			PROCEDURE 1 USING STANDARD TEST EQUIPMENT				
NO	NAME	232-A GLIDESLOPE SIGNAL GENERATOR	211-A SIGNAL GENERATOR	479S-3 AUDIO SIGNAL GENERATOR	313N-( ) CONTROL	PROCEDURE	OUTPUT		
							TEST POINT	TEST EQUIPMENT	RESULT
25.0						END OF TEST. Remove all test equipment from 51RV-2B.			

51RV-2B VOR/ILS Receiver, Preinstallation Test Procedures (Sheet 25 of 25)
Figure 507

PROCEDURE 2 USING 977A-1 TEST PANEL								COMMENTS FOR PROCEDURE 1 AND PROCEDURE 2
FREQUENCY	PROCEDURE	OUTPUT						
		DC VOLTAGE	AC VOLTS	CRO	TEST POINT	TEST EQUIPMENT	RESULT	
	END OF TEST. Remove all test equipment from S1RV-2B.							

3. POSTINSTALLATION TEST.

The postinstallation test procedures for the 51RV-2B are presented in tabular form in figure 508.

The ramp test for the 51RV-2B VOR/ILS Receiver, using the 479T-2, is intended as a go/no-go test for the VOR/ILS system installed in the aircraft. This test provides an operational test for the VOR/ILS system, including the 51RV-2B antenna, control unit, indicators, and the interconnect wiring. If an abnormal indication is obtained, remove the 51RV-2B as outlined in the removal/installation section and substitute a 51RV-2B known to be operational.

Before testing the 51RV-2B, read the following procedures.

A. When any block under test equipment settings is empty, that control has been properly set in a previous test and does not have to be changed.

B. All test equipment settings are repeated at the top of each page for reference.

C. The result column provides test limits and other end result indications.

D. Performing a complete test requires that all steps of the procedure be completed in the order shown.

TEST		TEST EQUIPMENT USED IN PROCEDURE 1 AND PROCEDURE 2			PROCEDURE 1 USING STANDARD TEST EQUIPMENT					PROCEDURE 2 USING 977A-1 TEST PANEL								COMMENTS FOR PROCEDURE 1 AND PROCEDURE 2
							OUTPUT					OUTPUT						
NO	NAME	232-A GLIDESLOPE SIGNAL GENERATOR	211-A SIGNAL GENERATOR	479S-3 AUDIO SIGNAL GENERATOR	313N-( ) CONTROL	PROCEDURE	TEST POINT	TEST EQUIPMENT	RESULT	FREQUENCY	PROCEDURE	DC VOLTAGE	AC VOLTS	CRO	TEST POINT	TEST EQUIPMENT	RESULT	
25.0						END OF TEST. Remove all test equipment from 51RV-2B.					END OF TEST. Remove all test equipment from S1RV-2B.							

51RV-2B VOR/ILS Receiver, Preinstallation Test Procedures (Sheet 25 of 25)
Figure 507

3. POSTINSTALLATION TEST.

The postinstallation test procedures for the 51RV-2B are presented in tabular form in figure 508.

The ramp test for the 51RV-2B VOR/ILS Receiver, using the 479T-2, is intended as a go/no-go test for the VOR/ILS system installed in the aircraft. This test provides an operational test for the VOR/ILS system, including the 51RV-2B antenna, control unit, indicators, and the interconnect wiring. If an abnormal indication is obtained, remove the 51RV-2B as outlined in the removal/installation section and substitute a 51RV-2B known to be operational.

Before testing the 51RV-2B, read the following procedures.

A. When any block under test equipment settings is empty, that control has been properly set in a previous test and does not have to be changed.

B. All test equipment settings are repeated at the top of each page for reference.

C. The result column provides test limits and other end result indications.

D. Performing a complete test requires that all steps of the procedure be completed in the order shown.

TEST/ STEP	313N-( ) CONTROL		479T-2 SIGNAL GENERATOR									
	POWER SWITCH	NAV FREQUENCY SELECTOR	METER	SET LINE TO 21V	MICRO-VOLTS	MEGA-HERTZ	CARRIER SET	AUDIO SELECTOR	NAV-GS	VOR	LOC-GS	
1.0 Ramp test												
1.1	PWR	114.90 MHz										Apply power LINE other near a instal brate to 479 tor, p signal full le 479T-
1.2			LINE	See procedure	200K	114.90						Adjus obtain 21 vol
1.3			CAR				See procedure					Adjus obtain 479T-
1.4								VOR	NAV	0°		Obser
1.5												Adjus degre indica
1.6										45°		Obser
1.7										315°		Obser
1.8										180°		Obser
1.9		110.10 MHz				110.10		TONE LOC			LEFT	Obser
1.10											RIGHT	Obser
1.11								GS	GS		UP	Conne GS OU retra indica

51RV-2B VOR/ILS Receiver, Postinstallation Test Procedures (Sheet 1 of 2)
Figure 508

PROCEDURE	RESULTS
power to aircraft. Apply to 479T-2 by rotating SET TO 21V switch to a position than OFF. Place 479T-2 ıircraft in which 51RV-2B is led. Ensure 479T-2 is cali- i. Connect 479T-2 antenna 'T-2 NAV OUTPUT connec- lace broadside to direction . is to be radiated, extend to ngth, and securely clamp to ·2 case.	
t SET LINE to 21V switch to 479T-2 meter indication of .ts.	479T-2 meter indicates 21 volts.
t CARRIER SET control to red-line indication on ·2 meter.	479T-2 meter indicates red line.
·ve RMI.	RMI reading is always reciprocal of VOR control setting.
t course indicator to zero e. Observe course tor.	Deviation bar centers. LOC flag is out of view. To-from indicator shows "from."
·ve course indicator.	Course indicator deviation bar deflects left.
·ve course indicator.	Course indicator deviation bar deflects right.
·ve course indicator.	Deviation bar centers. LOC flag is out of view. To-from indicator shows "to."
·ve course indicator.	Course indicator deviation bar deflects left, LOC flag out of view.
·ve course indicator.	Course indicator deviation bar deflects right.
:ct 479T-2 antenna to 479T-2 JTPUT connector, and fully :t antenna. Observe course .tor.	Course indicator glideslope needle deflects up. Glideslope flag out of view.

TEST/ STEP	313N-( ) CONTROL		479T-2 SIGNAL GENERATOR									
	POWER SWITCH	NAV FREQUENCY SELECTOR	METER	SET LINE TO 21V	MICRO-VOLTS	MEGA-HERTZ	CARRIER SET	AUDIO SELECTOR	NAV-GS	VOR	LOC-GS	
	PWR	110.10 MHz	CAR	Adjusted	200K	110.10	Adjusted	GS	GS	180°	UP	
1.12											DOWN	Obser
1.13								1000 ~				Liste aircr
2.0 VOR self-test				OFF								Remo Chan frequ excep 108.1 cours 180 d switc and R
3.0 ILS self-test												
3.1												Chan frequ hertz Actua cours
3.2												Actua cours

51RV-2B VOR/ILS Receiver, Postinstallation Test Procedures (Sheet 2 of 2)
Figure 508

TEST/ STEP	313N-( ) CONTROL		479T-2 SIGNAL GENERATOR									PROCEDURE	RESULTS
	POWER SWITCH	NAV FREQUENCY SELECTOR	METER	SET LINE TO 21V	MICRO-VOLTS	MEGA-HERTZ	CARRIER SET	AUDIO SELECTOR	NAV-GS	VOR	LOC-GS		
1.0 Ramp test													
1.1	PWR	114.90 MHz										Apply power to aircraft. Apply power to 479T-2 by rotating SET LINE TO 21V switch to a position other than OFF. Place 479T-2 near aircraft in which 51RV-2B is installed. Ensure 479T-2 is calibrated. Connect 479T-2 antenna to 479T-2 NAV OUTPUT connector, place broadside to direction signal is to be radiated, extend to full length, and securely clamp to 479T-2 case.	
1.2			LINE	See procedure	200K	114.90						Adjust SET LINE to 21V switch to obtain 479T-2 meter indication of 21 volts.	479T-2 meter indicates 21 volts.
1.3			CAR				See procedure					Adjust CARRIER SET control to obtain red-line indication on 479T-2 meter.	479T-2 meter indicates red line.
1.4								VOR	NAV	0°		Observe RMI.	RMI reading is always reciprocal of VOR control setting.
1.5												Adjust course indicator to zero degree. Observe course indicator.	Deviation bar centers. LOC flag is out of view. To-from indicator shows "from."
1.6										45°		Observe course indicator.	Course indicator deviation bar deflects left.
1.7										315°		Observe course indicator.	Course indicator deviation bar deflects right.
1.8										180°		Observe course indicator.	Deviation bar centers. LOC flag is out of view. To-from indicator shows "to."
1.9		110.10 MHz				110.10		TONE LOC			LEFT	Observe course indicator.	Course indicator deviation bar deflects left, LOC flag out of view.
1.10											RIGHT	Observe course indicator.	Course indicator deviation bar deflects right.
1.11								GS	GS		UP	Connect 479T-2 antenna to 479T-2 GS OUTPUT connector, and fully retract antenna. Observe course indicator.	Course indicator glideslope needle deflects up. Glideslope flag out of view.

51RV-2B VOR/ILS Receiver, Postinstallation Test Procedures (Sheet 1 of 2)
Figure 508

TEST/ STEP	313N-( ) CONTROL		479T-2 SIGNAL GENERATOR									
	POWER SWITCH	NAV FREQUENCY SELECTOR	METER	SET LINE TO 21V	MICRO-VOLTS	MEGA-HERTZ	CARRIER SET	AUDIO SELECTOR	NAV-GS	VOR	LOC-GS	
	PWR	110.10 MHz	CAR	Adjusted	200K	110.10	Adjusted	GS	GS	180°	UP	
1.12											DOWN	Obser
1.13								1000 ~				Liste aircr
2.0 VOR self-test				OFF								Remo Chanr frequ excep 108.1 cours 180 d switc and R
3.0 ILS self-test												
3.1												Chan frequ hertz Actua cours
3.2												Actua cours

51RV-2B VOR/ILS Receiver, Postinstallation Test Procedures (Sheet 2 of 2)
Figure 508

PROCEDURE	RESULTS
·ve course indicator.	Course indicator glideslope needle deflects down.
ı for 1000-Hz tone in ıft.	1000-Hz tone in aircraft.
ve power from 479T-2. ıel 51RV-2B to a local VOR ency (108.00 to 117.95 MHz t odd tenths of MHz from 0 to 111.90 MHz). Position e indicator to 0 degree or egrees. Actuate VOR test h. Observe course indicator MI.	VOR/LOC flag in view for up to 9 seconds (depending on slew time of RMI). Then course indicator deviation bar centers, RMI indicates 180 degrees. If test energize signal remains after 23 seconds from initiating test, VOR/LOC flag returns to view.
ıel 51RV-2B to any localizer ency (odd tenths of mega- from 108.10 to 111.90 MHz). te UP/L switch. Observe e indicator.	VOR/LOC and glideslope flags in view first 3 seconds after actuating UP/L. Then course indicator deviation bar moves left, glideslope pointer up, VOR/LOC and glideslope flags out of view. Deviation bar and glideslope pointer halfway between second and third dot on 5-dot indicator, or on first dot on 2-dot indicator. If test energize signal remains after 23 seconds, flags return to view.
te DN/R switch. Observe e indicator.	VOR/LOC and glideslope flags in view first 3 seconds after actuating DN/R. Then course indicator deviation bar moves right, glideslope pointer down. VOR/LOC and glideslope flags disappear. Deviation bar and glideslope pointer halfway between second and third dot on 5-dot indicator, or on first dot on 2-dot indicator. If test energize signal remains after 23 seconds, flags return to view.

51RV-2B VOR/ILS Receiver - Inspection/Check

1. GENERAL.

Included within this section are inspection/check procedures for the 51RV-2B VOR/ILS Receiver as installed in the aircraft. The equipment should be inspected periodically.

2. INSPECTION PROCEDURES.

A. Check to ensure that ARINC adapter is securely fastened to the NAV receiver.

B. Check to ensure that sway space is adequate and that no obstruction hinders shockmount or equipment rack from operating properly.

C. Check for damage to finish.

D. Check cabling to shockmount or aircraft equipment rack for dust, wear, broken wires, or poor connections.

E. Check shock isolators for correct operation.

F. Check to ensure that all shockmount bonding straps are properly installed.

G. Check to ensure that equipment is securely installed on shockmount and that knurled retaining knobs on shockmount are safety wired.

CAUTION: BE SURE THAT THE EQUIPMENT HOUSING AND MOUNT ARE BONDED ELECTRICALLY TO THE AIRFRAME.

TEST/ STEP	313N-( ) CONTROL		479T-2 SIGNAL GENERATOR									PROCEDURE	RESULTS
	POWER SWITCH	NAV FREQUENCY SELECTOR	METER	SET LINE TO 21V	MICRO-VOLTS	MEGA-HERTZ	CARRIER SET	AUDIO SELECTOR	NAV-GS	VOR	LOC-GS		
	PWR	110.10 MHz	CAR	Adjusted	200K	110.10	Adjusted	GS	GS	180°	UP		
1.12											DOWN	Observe course indicator.	Course indicator glideslope needle deflects down.
1.13								1000 ~				Listen for 1000-Hz tone in aircraft.	1000-Hz tone in aircraft.
2.0 VOR self-test				OFF								Remove power from 479T-2. Channel 51RV-2B to a local VOR frequency (108.00 to 117.95 MHz except odd tenths of MHz from 108.10 to 111.90 MHz). Position course indicator to 0 degree or 180 degrees. Actuate VOR test switch. Observe course indicator and RMI.	VOR/LOC flag in view for up to 9 seconds (depending on slew time of RMI). Then course indicator deviation bar centers, RMI indicates 180 degrees. If test energize signal remains after 23 seconds from initiating test, VOR/LOC flag returns to view.
3.0 ILS self-test													
3.1												Channel 51RV-2B to any localizer frequency (odd tenths of megahertz from 108.10 to 111.90 MHz). Actuate UP/L switch. Observe course indicator.	VOR/LOC and glideslope flags in view first 3 seconds after actuating UP/L. Then course indicator deviation bar moves left, glideslope pointer up, VOR/LOC and glideslope flags out of view. Deviation bar and glideslope pointer halfway between second and third dot on 5-dot indicator, or on first dot on 2-dot indicator. If test energize signal remains after 23 seconds, flags return to view.
3.2												Actuate DN/R switch. Observe course indicator.	VOR/LOC and glideslope flags in view first 3 seconds after actuating DN/R. Then course indicator deviation bar moves right, glideslope pointer down. VOR/LOC and glideslope flags disappear. Deviation bar and glideslope pointer halfway between second and third dot on 5-dot indicator, or on first dot on 2-dot indicator. If test energize signal remains after 23 seconds, flags return to view.

51RV-2B VOR/ILS Receiver, Postinstallation Test Procedures (Sheet 2 of 2)
Figure 508

51RV-2B VOR/ILS Receiver - Inspection/Check

1. GENERAL.

Included within this section are inspection/check procedures for the 51RV-2B VOR/ILS Receiver as installed in the aircraft. The equipment should be inspected periodically.

2. INSPECTION PROCEDURES.

A. Check to ensure that ARINC adapter is securely fastened to the NAV receiver.

B. Check to ensure that sway space is adequate and that no obstruction hinders shockmount or equipment rack from operating properly.

C. Check for damage to finish.

D. Check cabling to shockmount or aircraft equipment rack for dust, wear, broken wires, or poor connections.

E. Check shock isolators for correct operation.

F. Check to ensure that all shockmount bonding straps are properly installed.

G. Check to ensure that equipment is securely installed on shockmount and that knurled retaining knobs on shockmount are safety wired.

CAUTION: BE SURE THAT THE EQUIPMENT HOUSING AND MOUNT ARE BONDED ELECTRICALLY TO THE AIRFRAME.

51RV-2B VOR/ILS Receiver - Cleaning/Painting

1. GENERAL.

Included within this section is information concerning cleaning and painting while the equipment is installed in the aircraft.

2. CLEANING.

Remove dust from the 51RV-2B using a clean, soft, dry cloth.

3. PAINTING.

Painting is not recommended while the equipment is installed in the aircraft.

51RV-2B VOR/ILS Receiver - Approved Repairs

1. GENERAL.

No repairs are recommended for the 51RV-2B VOR/ILS Receiver while installed in the aircraft. If the equipment is faulty, refer to the removal/replacement procedures, and install a unit known to be operational.

CAUTION: BE SURE THAT THE EQUIPMENT HOUSING AND MOUNT ARE BONDED ELECTRICALLY TO THE AIRFRAME.

51RV-2B VOR/ILS Receiver - Illustrations

(Not Applicable)

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